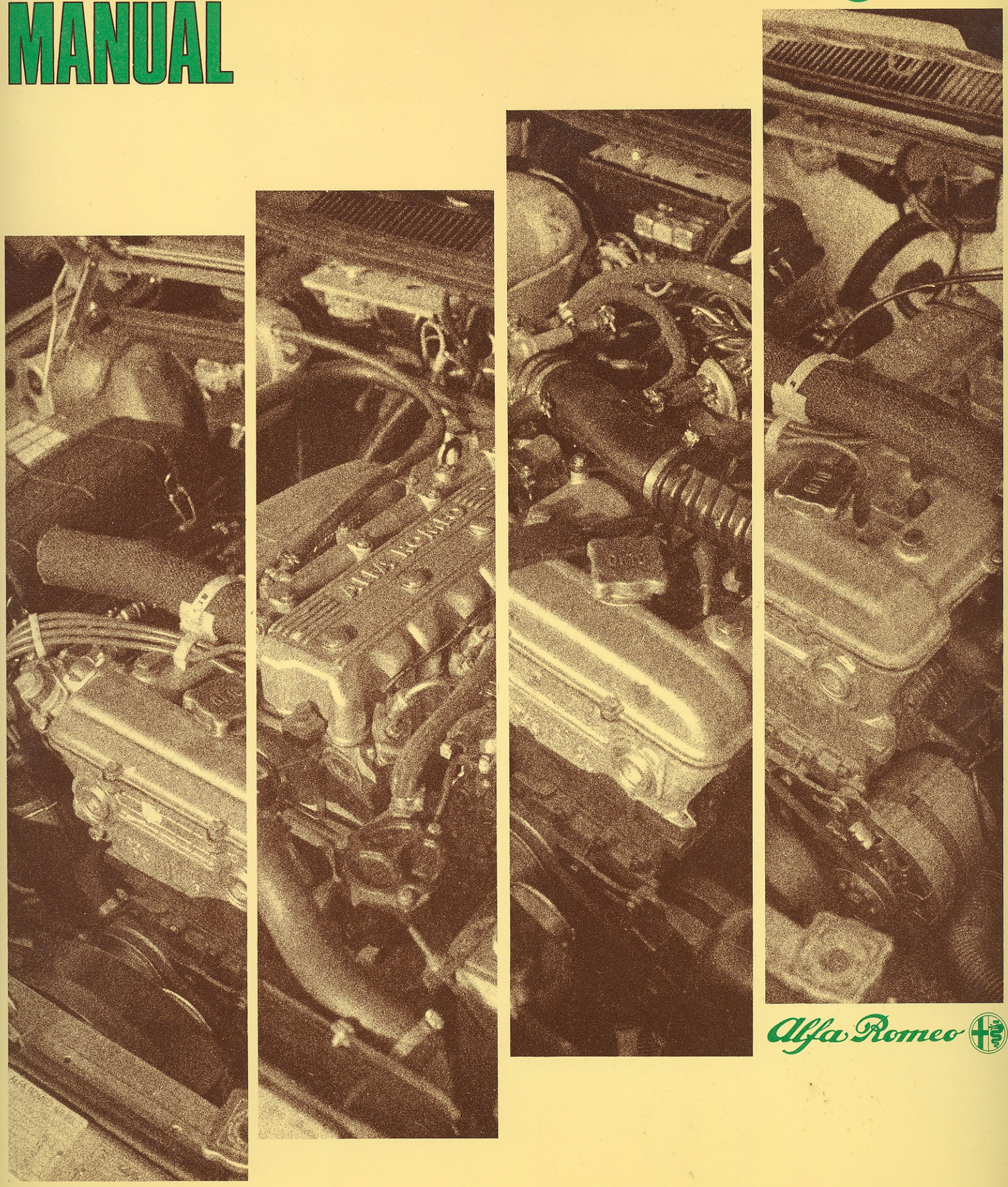
WORKSHOP MANUAL

engines



Alfa Romeo

DIREZIONE ASSISTENZA TECNICA

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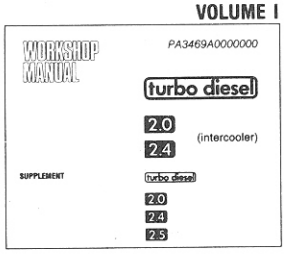
VOLUME I 	00	1	CONTENTS		May 1985
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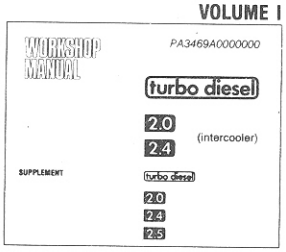
VOLUME I 	05	2	05-4		November 1986
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DIREZIONE ASSISTENZA TECNICA Alfa Romeo

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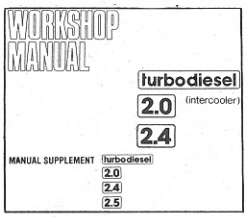	00	1	from CONTENTS		May 1985
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WORKSHOP MANUAL

turbodiesel

2.0 (intercooler)

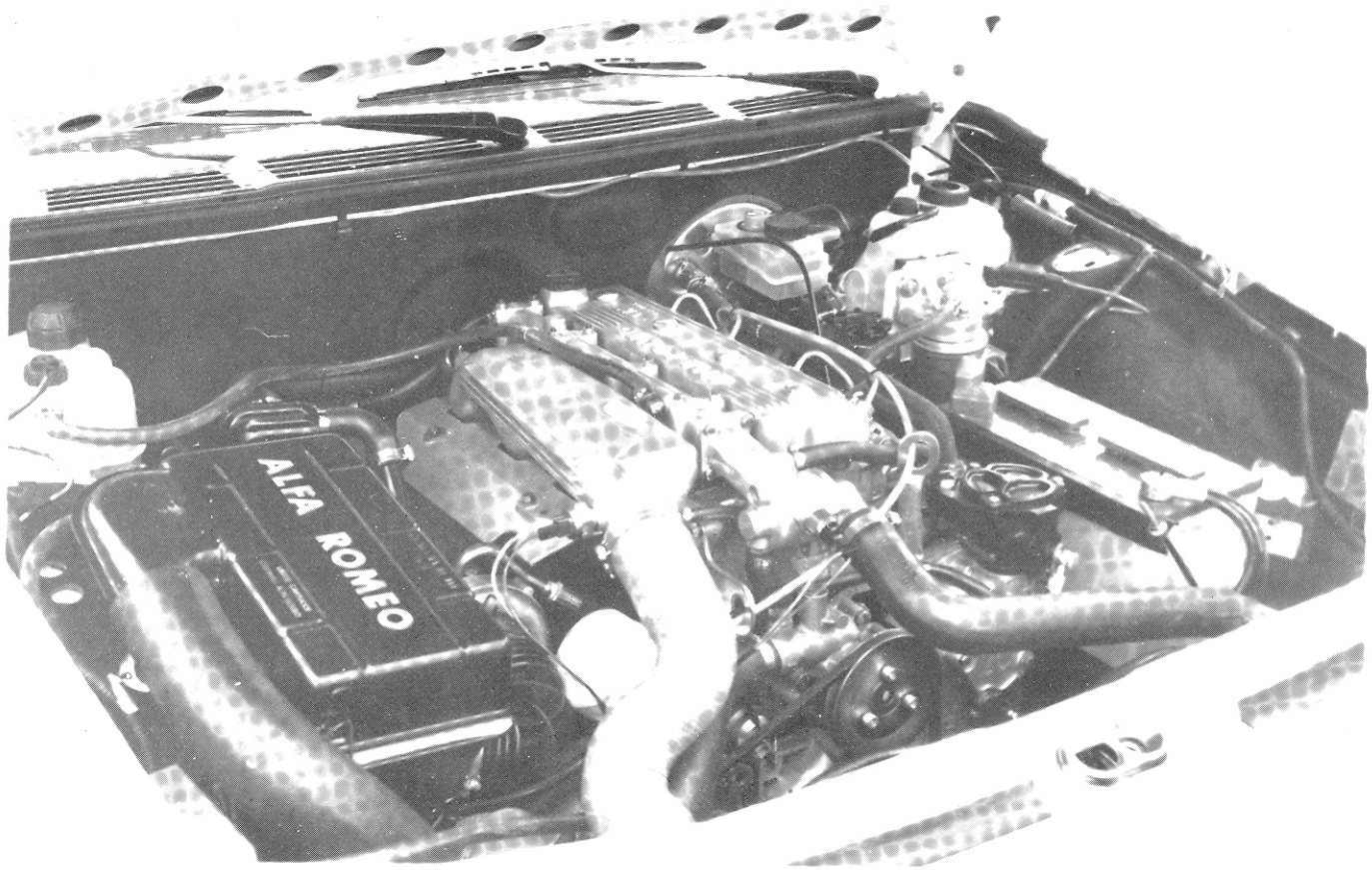
2.4

turbodiesel MANUAL SUPPLEMENT

2.0

2.4

2.5



DIREZIONE ASSISTENZA TECNICA

Alfa Romeo

PA3469A0000001

May 1985

FOREWORD

This manual is intended for use by workshops belonging to the ALFA ROMEO Service Organization. It contains all necessary instructions for tune up, repair and overhaul of the mechanical units with which the ALFA ROMEO cars are equipped. It includes procedures concerning removal and installation, disassembly and assembly, checks and inspections as well as instructions for effective trouble-shooting.

All operations are extensively illustrated so that the part or unit involved, as well as the proper tool to be used, are easily identified.

All data, figures, and technical specifications herein contained are up to date at time of publication. Any subsequent change in values or technical specifications occurring between reprints, will be included in the Technical Bulletins issued by the Service Department as changes take place.

The manufacturer reserves the right to make - at any time and without notice - all those changes that it deems necessary to improve the vehicle or arising out of manufacturing or commercial requirements. It further advises that not all models mentioned in this manual will be available in all countries.

HOW TO USE THE MANUAL

This manual is designed as a guide for personnel assigned to provide effective service to the mechanical units concerned. The instructions herein contained are in general common to all different models of the same group; when they are meant for one particular model, it is previously indicated with a specific detailed reference to be found in the CONTENTS and in the text.

All instructions given for the purpose of restoring faulty components to proper working conditions, do not necessarily reflect manufacturer's directives as regards service, but they must just the same be complied with. Furthermore, since most given instructions concern complete disassembly of components, they should be followed in their entirety only when it is strictly necessary.

For easier consultation of the manual, read the CONTENTS carefully.

The manual contains a SERVICE DATA AND SPECIFICATIONS chapter to be complied with when tuning up and repairing the vehicle. The specifications have been subdivided into four different items: Technical Data, General Specifications, Inspections and Adjustments, and Tightening Torques.

The manual also contains a TROUBLE DIAGNOSIS AND CORRECTIONS chapter where likely causes of trouble, as well as the relevant recommended corrective action, are listed.

The manual contains a list of SPECIAL SERVICE TOOLS designed to allow quick, accurate and safe repairs.

Measurements given in this manual are expressed in the International System of Units (SI) as well as in the metric system and in the yard/pound system.

Captions CAUTION and WARNING emphasize steps that must be followed with extreme care to avoid personal injury and/or damage to the vehicle or part of it.

Remember to keep the manual up-to-date with the data supplied by the "Technical Bulletin" periodically issued by the Service Department.

WORKSHOP INSTRUCTIONS

Disassembly and assembly operations should be always carried out using proper tools (general-purpose as well as special service tools) since makeshift tools will damage the parts involved.

To loosen tight fitting cast iron parts, just lightly strike them with a lead or aluminium hammer; use a wooden or plastic mallet to loosen light alloy parts.
Separate one by one the parts making up each unit and partially tighten nuts onto relevant studs or screws.

On disassembly, check if parts that should be marked do in fact have the relevant number or reference stamped on it. Any previously replaced part is found to be not properly marked, it should be stamped accordingly.

Before washing, clean all parts with a brush and cloth removing most dirt (thus avoiding needless dirtying of the washing fluid); then wash them with detergent or special compound. Remove any residual dirt with a jet of compressed air. Dry all parts immediately after washing to prevent them from rusting.

Thoroughly wash parts that have been ground or lapped and blow them with a jet of compressed air to remove all residues.

On assembly, clean all parts (especially those that have been ground) with a jet of compressed air or a clean brush.
On assembly also suitably lubricate parts (except self-lubricating bushes) to prevent seizure during their running-in period. To apply lubricant, use a clean brush as well as clean oil keeping them away from dust and dirt at all times and using them only for this special purpose.

Suitably protect with adhesive tape or clean cloths all engine parts that after disassembly show orifices or drilling which are likely to let in dust or foreign matter.

On assembly, replace all gaskets, seal rings, spring washers and lock rings in addition to all worn or damaged parts.

IMPORTANT NOTICE

When replacing units or parts thereof, be sure to use only original spare parts to ensure interchangeability as well as proper performance.

When ordering, remember to show the part number taken from the Spare Parts Catalogue or from the microfiches.
Service quality varies according to procedures used, personnel skill, and available tools and parts.

QUICK REFERENCE INDEX

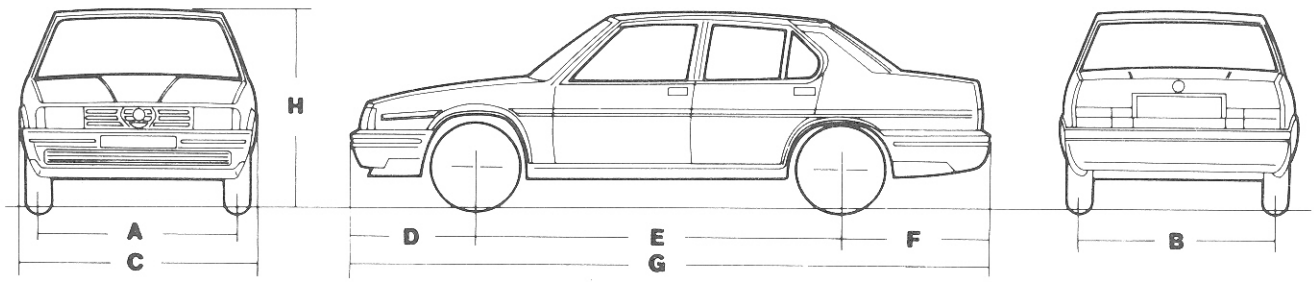
GROUP 00

CONTENTS

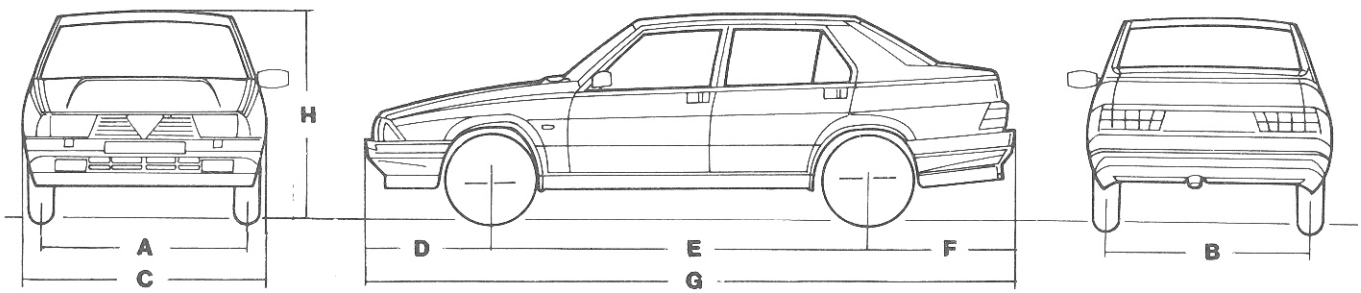
GENERAL VIEWS

DIMENSIONS

Alfa 90 2.4 turbodiesel Alfa 90 Super 2.4 turbodiesel

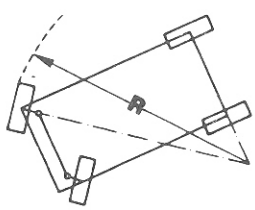


Alfa 75 2.0 turbodiesel



Unit: mm (in)

Model \ Dimensions	A	B	C	D	E	F	G	H Max	R(*)
Alfa 90 2.4 Alfa 90 Super 2.4	1366 (53.78)	1358 (53.46)	1638 (64.49)	861 (33.90)	2510 (98.82)	1020 (40.16)	4391 (172.87)	1420 (55.91)	5050 (198.82)
Alfa 75 2.0	1368 (53.86)	1358 (53.46)	1630 (64.17)	825 (32.48)	2510 (98.82)	995 (39.17)	4330 (170.47)	1400 (55.12)	5050 (198.82)



(*) Radius of the circumference described in correspondence with ground, from outer rim of the outer drive whell, when in the full steering look conditions

Weights and loads \ Model			Alfa 90 2.4 / Alfa 90 Super 2.4	Alfa 75 2.0
Max allowed gross weight	kg (lb)		1675 (3692.7)	1615 (3560.4)
Kerb weight (in running order)	kg (lb)		1250 (2755.7)	1190 (2623.5)
Payload	kg (lb)		425 (937)	
Max. allowed axle gross weight	kg (lb)	Front	940 (2072.3)	
		Rear	990 (2182.5)	
Max. towing gross weight	kg (lb)		1300 (2866)	
Seating capacity		Front	2	
		Rear	3	

WHEELS AND TYRES

Wheels and tyres \ Model			Alfa 90 2.4 / Alfa 90 Super 2.4	Alfa 75 2.0
Rims			$5\ ^{1}/_{2}$ J x 14" (1)	$5\ ^{1}/_{2}$ J x 13" (2)
Tubeless tyres			185/70 R 14 87T	185/70 R 13T
Inflating pressure [kg/cm^2] (3) (p.s.i.; bar; Kpa)	N	A	2.1 (30; 2.06; 205.9)	2.1 (30; 2.06; 205.9)
		P	2.1 (30; 2.06; 205.9)	2.1 (30; 2.06; 205.9)
	C	A	2.1 (30; 2.06; 205.9)	2.3 (33; 2.26; 225.5)
		P	2.3 (33; 2.26; 225.5)	2.3 (33; 2.26; 225.5)

A: Front
P: Rear
N: with reduced load and normal speed
C: at full load and high speed
T: up to 190 km/h (118 mph)

(1) Rims with five bolts
(2) Rims with four bolts
(3) Pressures measured on cold tyres

CAUTION:

The wheels nut must be tightened to 98 N·m torque (10 kg·m; 72.16 ft·lb)

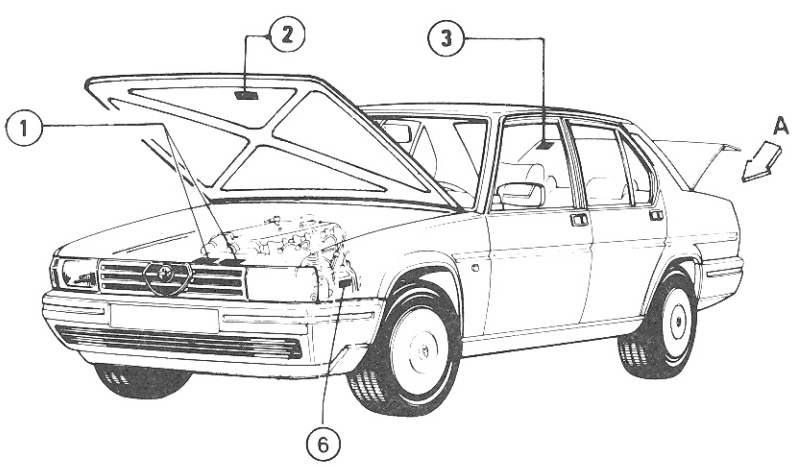
MODEL VARIATION

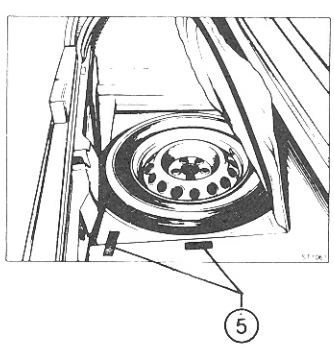
Identification \ Model		Alfa 90 2.4		Alfa 90 Super 2.4		Alfa 75 2.0	
Body		4 - door saloon					
Drive		LH	RH	LH	RH	LH	RH
Identification No.	— on identification label	162.06	—	162.06.1	—	161.040	—
Type approval No.	— on identification label	162 A3		162 A3		162 BD	
	— on the right rear side of luggage compartment floor	162 A30		162 A30		162 B00	
Serial No.	— on the right rear side of luggage compartment floor	from 00.001.011		from 00.014.011		from 00.001.011	
Engine type and serial No.	— on LH rear cylinder block	VM 81A from 00.001		VM 81A from 00.001		VM 80A from 00.001	

IDENTIFICATION DATA

IDENTIFICATION LABELS

Alfa 90 2.4 **Alfa 90 Super 2.4**

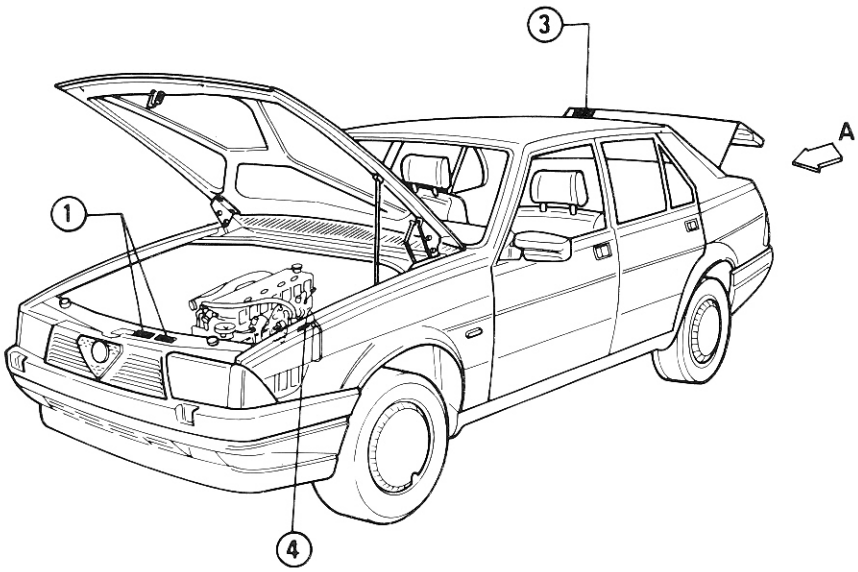




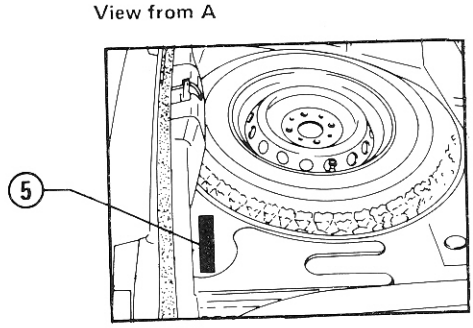
View from A

1. Identification and type approval label
2. Lubrication data label (lubrication data)
3. Paint label
4. Label on cylinder block LH rear side (Engine No.)
5. Luggage compartment floor label (vehicle type No. and chassis serial No.)
6. Injection pump number label

Alfa 75 2.0



View from A



1 Identification label (identification number and type approval number)
2 Lubrication label (lubrication data) (Location to be defined)
3 Paint products label
4 Label on engine block, left rear side (engine type and serial number)
5 Label on luggage compartment floor (type approval number and serial number).

VEHICLE IDENTIFICATION CODES

A) Chassis numbering

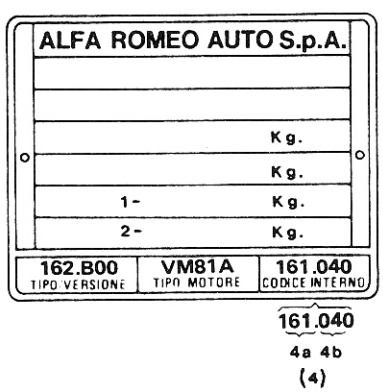
It is composed of groups of numbers and/or reference identifications

(2a) (2b)

Z A R 162.B00★00.001.011
(1) (2) (3)

(1) Manufacturer identification characters.
(2) Number of "Type and version approved".
It is composed of six figures, subdivided as follows:
(2a) Base type number: is assigned to each vehicle having a common design project (ex. **162 series** Alfa 90 and the series based on it, Alfa 75).
(2b) Type variant number: identifies the variations within the base type (ex. **162 B 00** Alfa 75 2.0 turbodiesel).

(3) Serial number: is progressively assigned at factory.



(4) Identification number (on identification label).
It is composed of five figures, subdivided as follows:
(4a) Basic type code: is assigned to all vehicles having a common design project to distinguish the various models (**162 series** Alfa 90 ; **161 series** Alfa 75).
(4b) Type variant number: identifies, within the base type, those vehicles that differ because of some variant that alters their features (ex. **161.04** Alfa 75 2.0 turbodiesel LHD).

For servicing purposes, indicate only the identification number (4).

B) Engine numbering

VM 80 A 00.001
(1) (2)

(1) Type number (ex. **VM 80 A engine 2.0** turbodiesel intercooler; **VM 81 A** 2.4 Turbodiesel intercooler engine).
(2) Engine serial number: is progressively assigned at factory.

GROUP 01

CONTENTS

ENGINE REMOVAL AND INSTALLATION

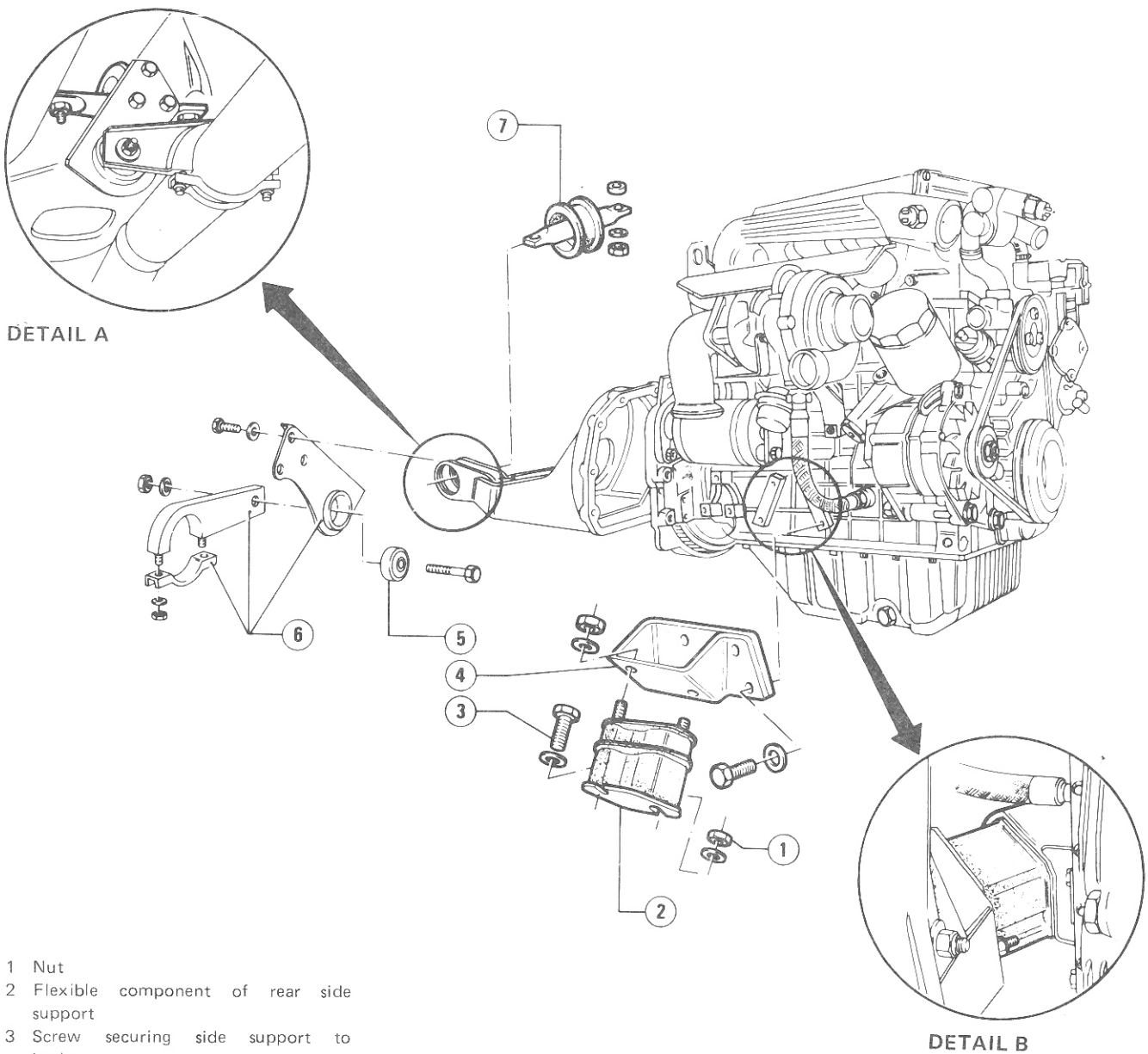
FOREWORD

This section contains all the data and procedures relating to the removal and installation of the engines fitted on the following Alfa Romeo vehicles:

Alfa 75 2.0 turbodiesel (VM 80A)
Alfa 90 2.4 turbodiesel and
Alfa 90 Super 2.4 turbodiesel (VM 81A)

Since the operations involved in removing and installing the propeller unit are somewhat numerous, the operator is urged to read the intervention procedures carefully, and to examine with care the illustrations of the assembly that give an indispensable, but of course incomplete, overall view of the engine.
Following the above advice permits the correct operational techniques to be acquired for each vehicle and familiarizes the technician with the technical data, and caution and warning captions.

Engine supports location

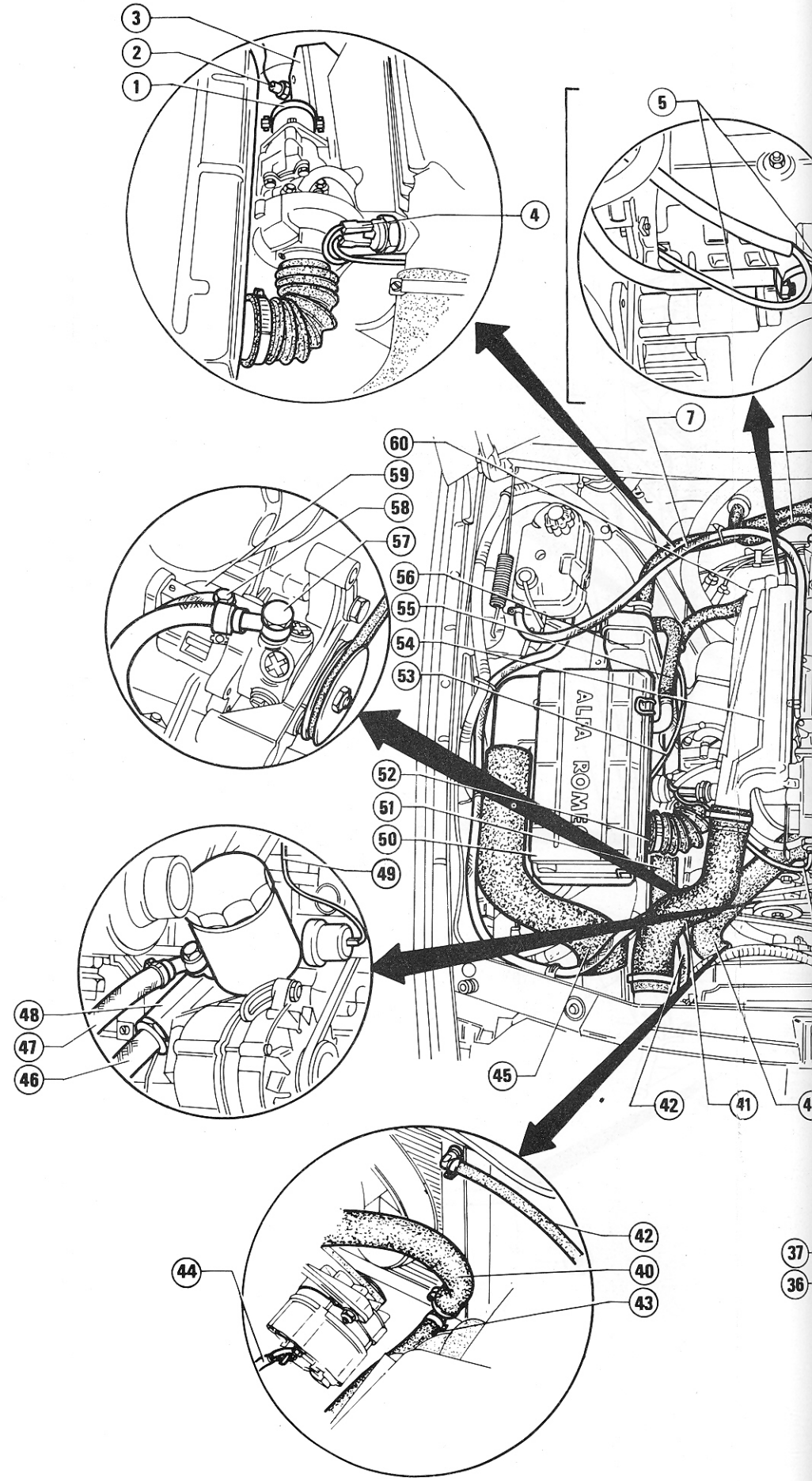


1 Nut
2 Flexible component of rear side support
3 Screw securing side support to body
4 Bracket for right side support
5 Rubber bushing for exhaust pipe support brackets
6 Brackets for exhaust pipe central support
7 Rear support

Detail A: Rear support
Detail B: Right side support

COMPONENTS TO BE DETACHED FROM ENGINE COMPARTMENT

1 Exhaust pipe securing collar
2 Cable for min oil pressure sender
3 Starter cover
4 Cables for supercharging air pressure indicator
5 Starter supply cables
6 Engine compartment connector cable
7 Head breather hose
8 Coolant - to heater delivery hose
9 Oil vapour breather hose
10 Injector drain hose
11 Injection pump drain hose
12 Pulse transmitter cable for electronic rev counter
13 Power steering oil tank
14 Clamp
15 Power steering system oil delivery/return hoses
16 Pre-heating glow plugs supply cable
17 Oil dipstick
18 Oil level sensor cables for ALFA ROMEO Control
19 Control cable for engine stop electromagnet
20 Battery
21 Accelerator ball joint
22 Cable for r.p.m. - activated microswitch
23 Accelerator sheath support bracket
24 Fuel - to filter delivery hose
25 Hose for fuel suction from tank
26 Fuel - to injection pump delivery hose
27 Freon inlet/outlet pipes to/from compressor
28 Ground cable
29 Air conditioner compressor
30 Supply cable for compressor electromagnet coupling
31 Servobrake vacuum intake hose
32 Bundle of cables
33 Screw securing radiator to body
34 Electric fans enabling cables
35 Electric fans
36 Movable connectors for electric fans supply cables
37 Radiator
38 Coolant - to radiator delivery sleeve
39 Cable for coolant temperature indicator and max temp. warning lamp
40 Sleeve for coolant return from radiator
41 Air to supply manifold delivery hose
42 Radiator breather hose
43 Return hose from radiator
44 Alternator and alternator warning lamp supply cables
45 Air intake sleeve
46 Oil - to oil radiator delivery hose
47 Oil - from oil radiator return hose
48 Oil filter support
49 Oil pressure indicator support
50 Air filter cover
51 Air - to intercooler delivery sleeve
52 Air - to turbocharger delivery sleeve
53 Oil return hose
54 Air supply manifold
55 Oil vapour return hose
56 Oil vapour sedimenter
57 Inlet union to power steering pump
58 Outlet union from power steering pump
59 Power steering pump
60 Heat shield



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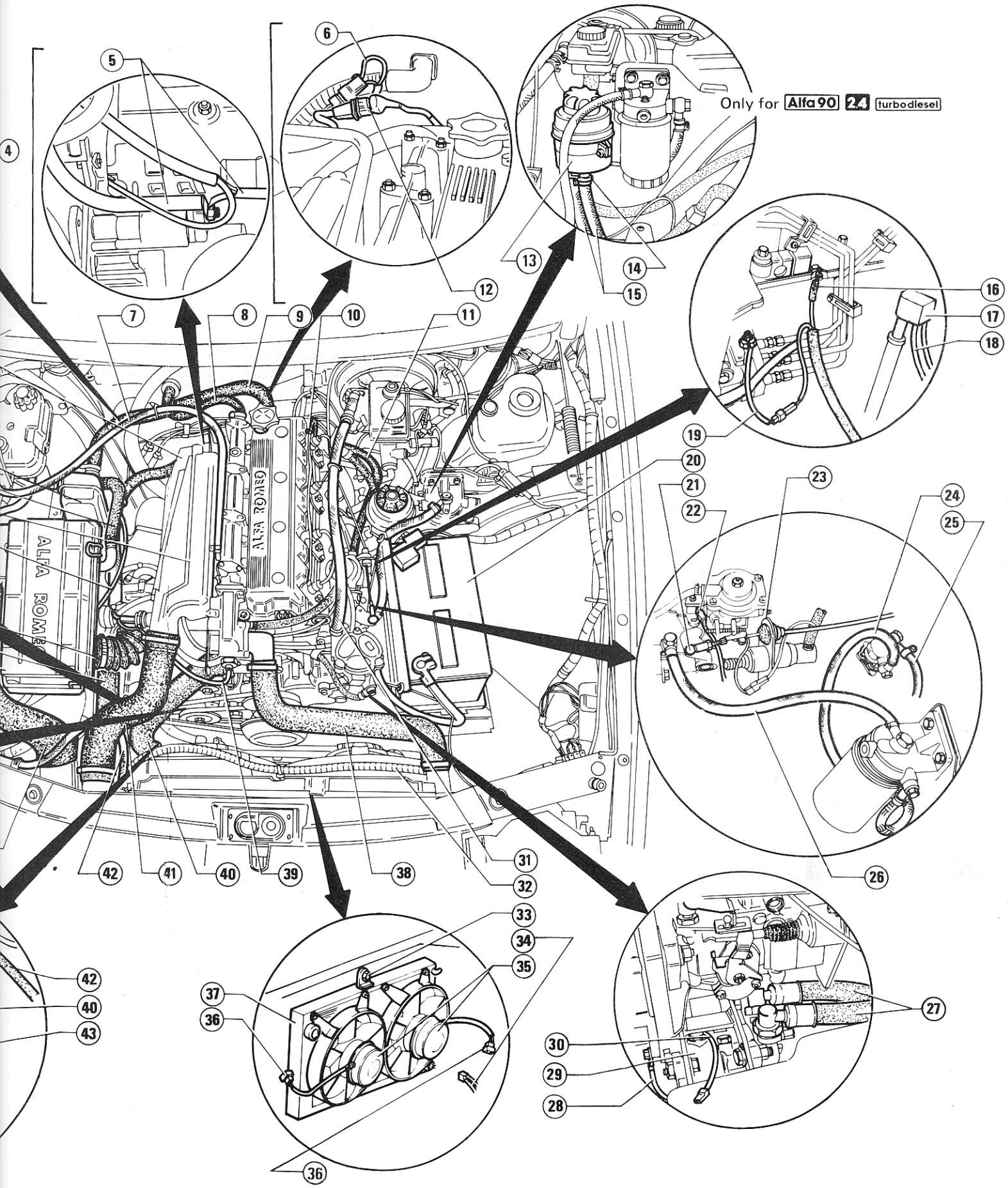
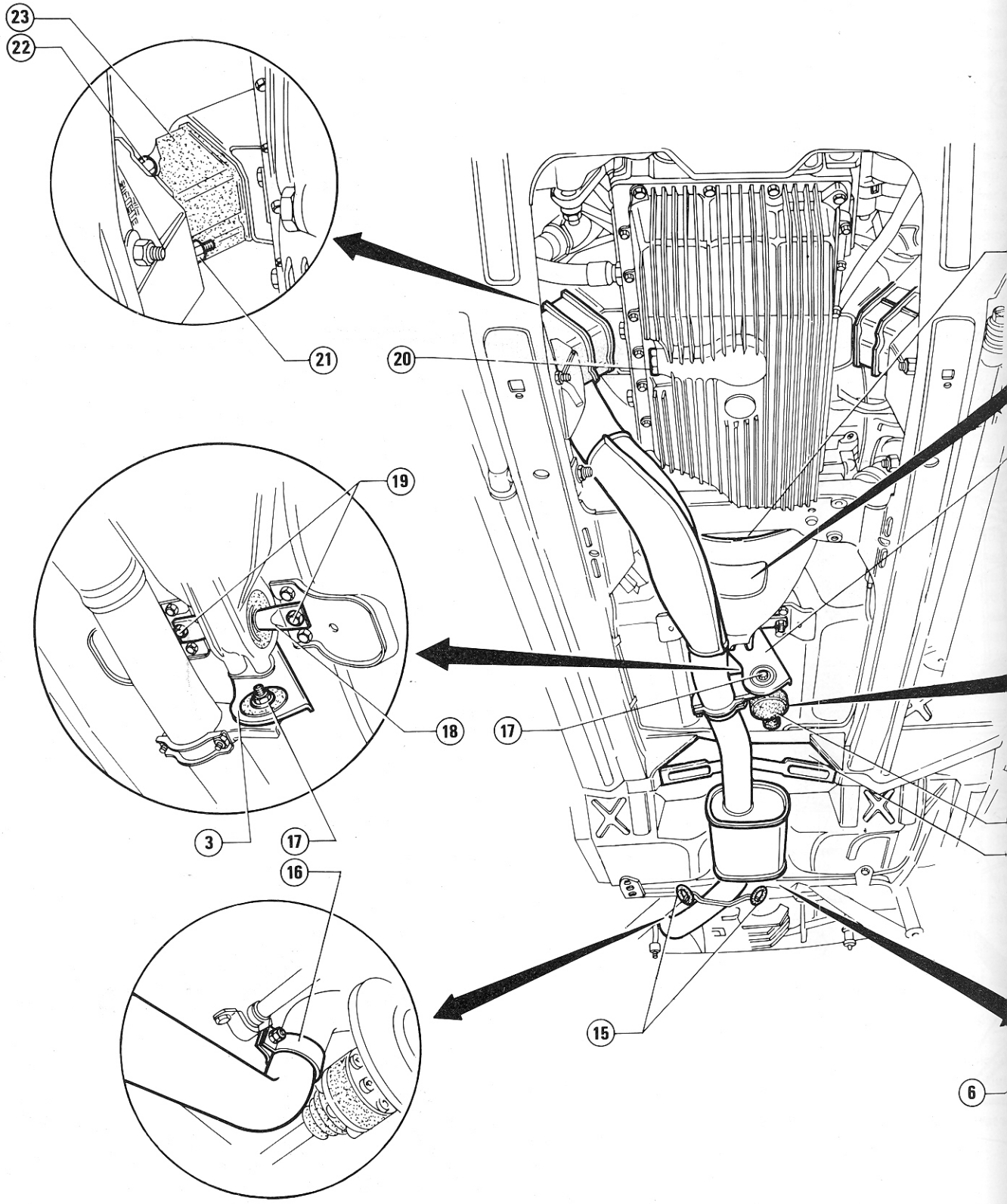
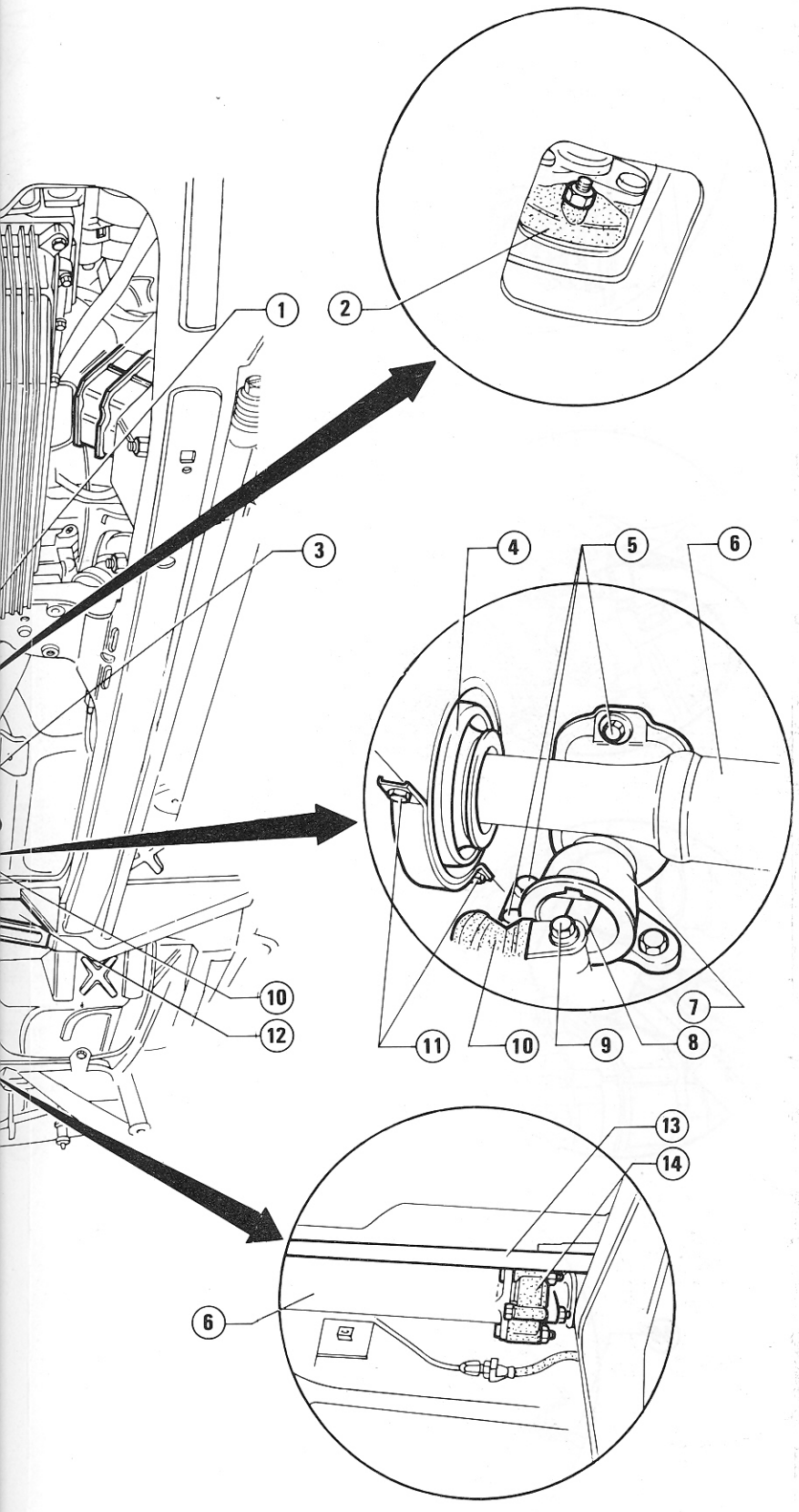


COMPONENTS TO BE DETACHED FROM VEHICLE LOWER SIDE





1 Engine flywheel cover
2 Front coupling
3 Support
4 Drive shaft central support
5 Screws securing speed control lever
6 Propeller shaft
7 Speed control lever support
8 Speed control lever
9 Bolt securing lever to speed control rod
10 Boot
11 Nuts securing propeller shaft central support
12 Central cross member
13 Speed control rod
14 Rear coupling
15 Retaining rings supporting exhaust pipe
16 Clamp
17 Bolt securing exhaust pipe to support
18 Engine rear support pin
19 Screws securing engine rear support to body
20 Oil drain plug
21 Engine side support lower securing nut
22 Engine side support upper securing screw
23 Engine side support

REMOVAL

NOTE:
The numbers specified in the following procedure refer to the «View of engine compartment» figure relevant to the car concerned.

1. Preliminary operations

a. Set vehicle on a lift and lock the wheels with suitable safety chocks.
b. Raise the protective caps on the nuts securing the wiper arms, unscrew the nuts and remove arms complete with blades.
c. Open the bonnet and suppot it with support rod provided.

WARNING:
Proceed with care when working on a hot engine to avoid being burned.

d. Disconnect the terminals from battery (20) and the anchoring brackets; then remove battery together with the container underneath.
e. — *For vehicles*

Alfa 90 2.4 turbodiesel

Alfa 90 Super 2.4 turbodiesel

If necessary, disconnect supply and ground cables of the engine compartment lamp.

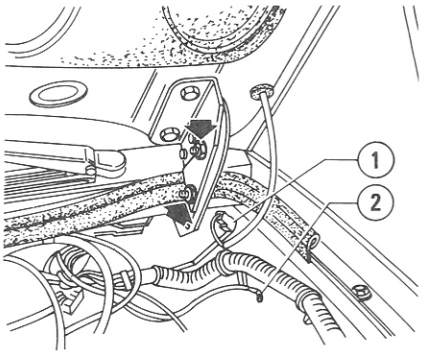
— *For vehicles*

Alfa 75 2.0 turbodiesel

Detach the roof lamp supply cable from the related clamp.
f. Support bonnet, unscrew and remove the bolts securing hinges, then tilt it back completely.

CAUTION:
Protect the bonnet contact areas with soft cloth.

WARNING:
For maximum safety, the bonnet should be kept in position using the method the operator considers most suitable.
Ignoring this advice, can result in the bonnet closing unexpectedly.



1 Engine compartment lamp power supply cable movable connector.
2 Engine compartment lamp ground cable terminal

g. Disconnect piping (31) from servobrake.

2. Removal of air and fuel system components

a. Disconnect the following hoses and sleeves, and remove them from the indicated part.

- Hose (10), from pipe on head
- Hose (11), from injection pump
- Hose (26), from injection pump
- Hoses (24) and (25), from fuel pump

WARNING:
Keep piping pointing upwards to prevent fuel escaping.
Ensure also that the workshop is correctly equipped to enable operations to be performed safely.

- Hose (53), from sedimenter (56)
- Hoses (9) and (55) from tappets cover and sedimenter (56)
- Sleeve (52), from turbocharger
- Sleeve (41), from intake manifold and intercooler, then remove sleeve
- Sleeve (51), from turbocharger.

b. Release clips and remove air filter cover (50) together with sleeve (45). Remove also the filtering element.
c. Unscrew the three nuts securing air filter casing to body, and remove it.
d. Unscrew the securing screws, and remove oil vapour sedimenter (56).

3. Detachment of accelerator control cable

a. Release and remove the clamps securing ball joint (21).
b. Loosen the locknut securing ball joint (21), unscrew the ball joint and locknut.
c. Remove the accelerator cable from bracket (23).

4. Detachment of cooling system piping

Detach the following hoses and sleeves, and remove them from the indicated side.

- Sleeve (40) from pump

Place a suitable container under the vehicle, so as to recover coolant.

- Sleeve (38), from thermostat unit
- Hose (42), from radiator
- Hose (7), from manifold on head
- Hose (8), from head
- Hose (43), from union-Tee near radiator.

5. Radiator removal

a. Disconnect cable (34), from thermal switch on radiator.
b. Detach movable connectors (36) for the electric fan supply cables.
c. Release cable bundle (32) from the fasteners on radiator.
d. Unscrew screw (33) and remove radiator (37) togeher with electric fans (35).

6. Removal of thermal shield, starter cover and exhaust pipe collar

a. Unscrew the nuts and remove thermal shield (60) from exhaust manifold.

b. Unscrew the two nuts and the screw securing cover (3) and remove it.

c. Unscrew the securing bolt, and remove collar (1).

7. Detachment of electric cables

Detach the following cables, and remove them from the indicated part.

- Cable (28) from engine.
- Cable (30) from connection of compressor electromagnetic coupling (if any compressor is fitted).
- Cable (19), from the movable connector.
- Cable (22), from switch on injection pump.
- Cable (16), from coupling strips.
- Cable (18), from oil dipstick (17).
- Cable (12), from movable connector.
- Cable (6), from engine compartment wiring connector.
- Cable (39), from bulb on manifold.
- Cable (4), from pressure switch on intake manifold (54).

For vehicles

Alfa 90 2.4 turbodiesel

Alfa 75 2.0 turbodiesel

— Cable (49) from bulb of oil filter support.

— Cable (2) from engine block bulb.

For vehicles

Alfa 90 Super 2.4 turbodiesel

— Cable (49) and cable (2) respectively from bulb and manual contact on union in rear part of engine.

— Cables (5), from starter motor.

— Cables (44) from alternator.

Withdraw the wiring connecting starter motor to alternator towards engine front side.

Detach the electric cables from any clamps, separate them from the engine to prevent them obstructing the unit's removal.

8. Removal of alternator and power steering system

a. Unscrew the bolts securing alternator, loosen alternator belt and remove it from pulley.

b. Remove the bolts previously loosened, then remove the alternator.

c. Unscrew plug of tank (13), suck the oil with a syringe, then screw plug.

d. Unscrew and detach the two unions (57) and (58) from power steering pump (59) and detach the clamp which secures hoses to alternator lower bracket.

NOTE:
Alternative procedure to points c. and d. mentioned above:
- **Remove the three bolts securing the power steering pump pulley drive belt.**
- **Remove the four bolts securing the pump bracket and fix the pump and the relevant bracket on the left side of the vehicle.**

e. *For vehicles*

Alfa 90 2.4 turbodiesel

Alfa 90 Super 2.4 turbodiesel

Loosen clamp (14), withdraw tank (13) and secure it to vehicle left-hand side. Unscrew the nuts securing clamp (14) to body; remove clamp. Unscrew the nuts securing clamp (14) to body; remove clamp.

9. Detachment of air conditioner compressor piping

a. Bleed Freon from the air conditioning system.

b. Unscrew unions of hoses (27) and detach them from compressor (29).

NOTE:
Alternative procedure to points a. and b. mentioned above:
- **Remove the air-conditioning system compressor drive belt.**
- **Remove the bolts securing the compressor to the relevant support and fix the compressor on the left side of the vehicle.**

10. Detachment of engine oil piping from oil filter support

Only for vehicles

Alfa 90 2.4 turbodiesel

Alfa 75 2.0 turbodiesel

Unscrew and disconnect the unions of oil delivery/return hoses (46) and (47) to/from radiator, from filter support.

Keep piping pointing upwards to prevent oil radiator from draining out.

NOTE:
The numbers specified in the following procedures refer to the «Components to be detached from vehicle lower side» figure relevant to the car concerned.

11. Oil draining (if required, in relation to the operations to be performed)

a. Raise vehicle on a lift.

b. Unscrew plug (20) and drain engine oil.

At the end of the operation, tighten plug.

12. Exhaust pipe removal

a. Loosen clamp (16) which connects front section to tail pipe.

b. Loosen bolt (17) which secures support (3); support the front section of exhaust pipe, and withdraw bolt.

e. Support the exhaust pipe, release it from support rings (15) and remove it by disconnecting it from tail pipe.

13. Propeller shaft removal

Only for vehicles

Alfa 90 Super 2.4 turbodiesel

— Remove heat shield (24) unscrewing the relevant securing screws.

a. Remove central cross member (12) by unscrewing the screws securing to body.

b. Remove boot (10), unscrew and remove bolt (9) by detaching lever (8) from speed control rod (13). If required, unscrew the four screws (5) securing support (7), and move it so as to make the propeller shaft removal easier.

c. Unscrew the securing bolts, and remove engine flywheel cover (1).

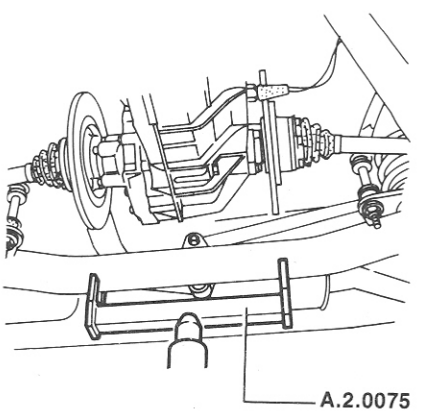
d. With speed gear into neutral, and rotating propeller shaft (6), unscrew, alternatively, the bolts and nuts which connect front coupling (2) to engine flywheel, and rear coupling (14) to clutch fork.

e. Unscrew the two screws (19) and remove pin (18) of engine rear support, from body.

f. Unscrew nuts (11) and detach propeller shaft central support (4) from body.

g. Unscrew the screws securing rear cross member to body.

h. Raise rear axle by means of a column lift fitted with cradle **A.2.0075**; then remove propeller shaft from clutch fork.



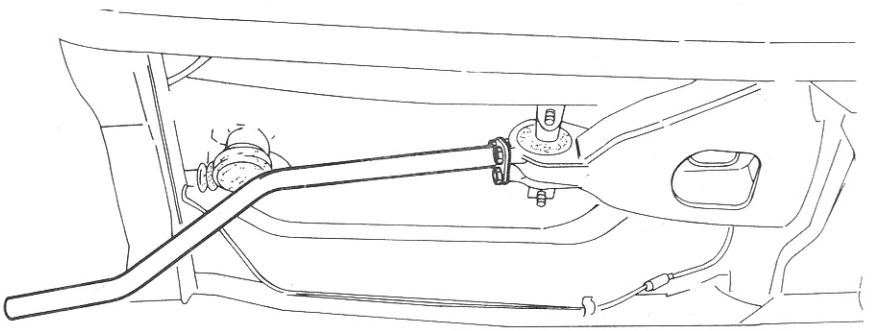
A.2.0075

i. Lower column lift and remove propeller shaft.

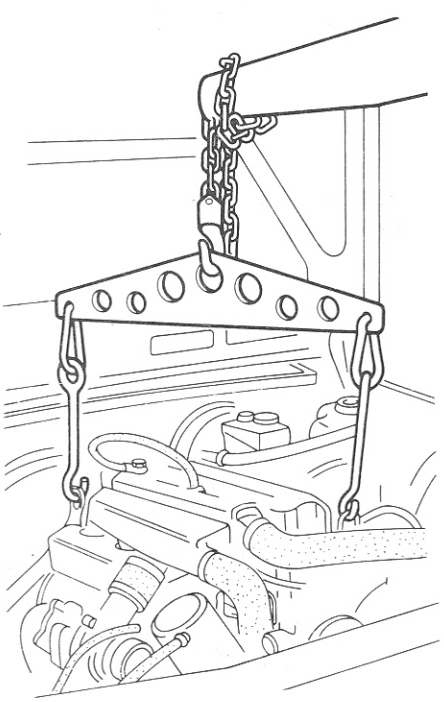
14. Final operations

a. Unscrew the securing screws, and remove support (3) of exhaust pipe.

b. Fit a suitable operating lever on the engine rear support to aid engine removal operations.



c. Unscrew and remove nuts (21) securing lower part of side supports (23).
d. Lower the lift, then unscrew screws (22) securing upper part of side supports (23).
e. Hook the engine on the lifting brackets, lift it out of the engine compartment with a hoist, positioning it with the operating lever.



CAUTION:
Proceed with great care so as to avoid damaging the servo-assisted steering box.

INSTALLATION

For the following steps refer to the «View of Underbody» figure relevant to the car concerned.

1. Preliminary operations

a. Fit the operating lever on engine rear support.
b. Hook the engine on the appropriate lifting bracket, and using a hoist, drop it slowly into the engine compartment, positioning it as necessary with the operating lever.

CAUTION:
Proceed with great care to avoid damaging the servo-assisted steering box.

c. Centre the engine in its compartment, resting it on the two side supports, and make sure that the screw and stud holes correspond on both supports.
d. Insert and lock, on both sides, screws (22) securing the flexible supports to cross member.
e. Lift vehicle, screw and tighten, on both sides, nuts (21) securing the lower part of flexible supports to cross member.
f. Remove the operating lever from the engine rear support; then install bracket (3) on support, securing it with the related screws.

2. Propeller shaft installation

a. Reinstall the complete propeller shaft on the vehicle, by reversing the order of removal, and complying with the following instructions.

– **Lubricate** propeller shaft front bush and the rear coupling spherical seat with **5 cm³** of **ISECO MOLYKOTE BR2** grease.

– Rotate the propeller shaft a little at a time, blocking it in a suitable way, and tightening the flexible couplings bolts and nuts to the prescribed torque.

(T) : **Tightening torque**
Nuts and bolts securing propeller shaft flexible couplings to engine flywheel and clutch fork
55 to 57 N·m
(5.6 to 5.8 kg·m;
40.5 to 41.9 ft·lb)

– Tighten the nuts which secure propeller shaft central support to vehicle floor.

(T) : **Tightening torque**
Nuts securing propeller shaft central support
93.2 to 103 N·m
(9.5 to 10.5 kg·m;
68.7 to 75.9 ft·lb)

b. Secure pin (18) of engine rear support to body.
c. Install engine flywheel cover (1).
d. Reconnect rod (13) to speed control lever (8), by means of bolt (9); then fit boot (10).
e. Secure central cross member (12) to body.

3. Exhaust pipe installation

a. Connect front section of exhaust pipe to tail pipe fitted with clamp.
b. Secure front section to retaining rings (15), and insert securing bolt (17) of support.
c. Align piping so that front section inlet corresponds to the union on turbocharger.
d. Tighten bolt (17) of central flexible support, and bolt of clamp (16) securing tail pipe.

For the following steps refer to the «View of Engine Compartment» figure relevant to the car concerned.

4. Exhaust pipe front connection

Lower vehicle and connect exhaust gas pipe, from the front side, to the union on turbocharger outlet, locking collar (1).

5. Reconnection of engine piping

Only for vehicles

Alfa 90 2.4 turbodiesel

Alfa 75 2.0 turbodiesel

Reconnect the delivery/return hoses to/from oil radiator to oil filter support.

6. Reconnection of Freon piping

Reconnect unions of Freon inlet/outlet hoses (27) to compressor (29), verifying that the O-ring on unions is properly inserted. If the compressor with the relevant support has been removed during the engine removal phase, install them proceeding in reverse order as against the note to «Detachment of Air Conditioner Compressor Piping».

7. Installation of power steering pump piping - alternator installation

a. Connect unions of inlet/outlet hoses (58) and (57) respectively, to pump; tighten unions to the prescribed torques.

(T): Tightening torques

Union for oil outlet hose on power steering pump
28 to 31 N·m
(2.9 to 3.2 kg·m;
21 to 23.1 ft·lb)

Union for oil inlet hose on power steering pump
45 to 50 N·m
(4.6 to 5.1 kg·m;
33.3 to 36.9 ft·lb)

NOTE:
If the power steering pump with its bracket has been removed during the engine removal phase, install it proceeding in reverse order as against the note to «Removal of Alternator and Power Steering System».

b. Secure the power steering system hoses support clamp on alternator lower bracket.
c. Position alternator and insert the lower securing bolt; screw bolt without tightening.
d. Position the alternator upper securing bolt and fit drive belt on pulley.
e. Move the alternator outwards so as to obtain the belt tensioning required; then tighten both upper and lower securing bolts of alternator.

Load to be applied on the middle of belt:
P = 15 ± 1 kg (33.07 ± 2.20 lb)
Deflection: f = 20 mm (0.787 in)

8. Reconnection of electric connections

Restore the electric connections, by reversing the order of the procedure described in "Removal" - step 7.

9. Connection of heat shield

Install cover (3) and heat shield (60).

10. Radiator installation

Install radiator (37) together with electric fans, and secure it to vehicle; then reconnect cables (34) and (36) for the electric fan supply enabling.

11. Reconnection of cooling piping

Reconnect the cooling system piping, by reversing the order of the procedure described in "Removal" - step 4.

12. Reconnect the accelerator control according to the following procedure.

a. Pass control cable through bracket (23).
b. Reconnect ball joint (21) to accelerator lever on injection pump and secure it with the related clip.

13. Connections of air and fuel supply system

Install the air and fuel supply system by reversing the order of the procedure described in "Removal" - step 2.

14. Final operations

a. Reconnect the servobrake vacuum intake hose (31) to vacuum pump.
b. *Only for vehicles*

Alfa 90 2.4 turbodiesel

Alfa 90 Super 2.4 turbodiesel

Fit clamp (14) and secure power steering oil tank (13).
c. Place battery into the engine compartment, together with container underneath,

secure battery by means of the securing bracket.

d. Carry out refilling and adjustment, refer to Group 04 and **Alfa 90** WORKSHOP MANUAL - Group 00 and Group 80.

- Engine oil
- Engine coolant
- Oil for power steering system
- Freon for air conditioning system
- Adjustment of engine idle r.p.m.
- Adjustment of accelerator control cable
- Adjustment of control lever for r.p.m. - activated microswitch
- Adjustment of fast idle at starting

e. Release bonnet, support it and re-fit the hinge securing bolts on both vehicle sides.

f. *For vehicles*

Alfa 90 2.4 **turbodiesel**

Alfa 90 Super 2.4 **turbodiesel**

If previously disconnected. restore the wiring of the engine compartment lamp ground and supply cables; then reconnect the battery terminals.

g. Install wiper arms.

PRELIMINARY OPERATIONS

Alfa 90 2.4 turbodiesel

Alfa 90 Super 2.4 turbodiesel

Alfa 75 2.0 turbodiesel

Refer to the relevant paragraph in the Workshop Manual for

turbodiesel 2.0 2.4 2.5

(PA346900000000)

proceeding as specified in relation to

Alfetta 2.4

ENGINE MAIN MECHANICAL UNIT

Alfa 90 2.4 turbodiesel

Alfa 75 2.0 turbodiesel

Refer to the relevant paragraph in the Workshop Manual for

turbodiesel 2.0 2.4 2.5

(PA346900000000)

proceeding as specified in relation to

Alfetta 2.4

Alfa 90 Super 2.4 turbodiesel

Refer to the relevant paragraph in the Workshop Manual for

turbodiesel 2.0 2.4 2.5

(PA346900000000)

proceeding as specified in relation to

Alfetta 2.4

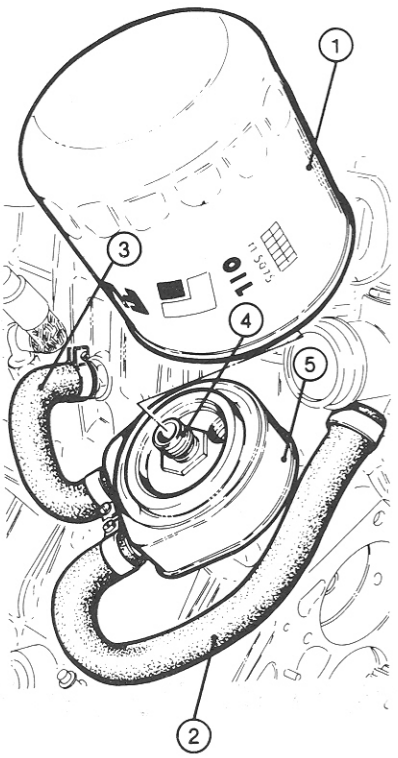
apart from steps 1., 3i., 4b., 8., 10., 14., 19d. which are modified as follows:

- **1. Removal of oil filter and water-to-oil heat exchanger**

a. Unscrew oil filter (1) using an appropriate wrench and remove it.

b. Detach hoses (2) and (3) respectively from the water pump and the engine block union.

c. Slacken and remove union (4) securing the filter; then remove heat exchanger (5).



1. Oil filter
2. Water hose, pump to heat exchanger
3. Water hose, heat exchanger to engine block
4. Union
5. Water-to-oil heat exchanger

- **3i.** Not applicable

- **4b.** Parts (1) and (3) do not apply here.

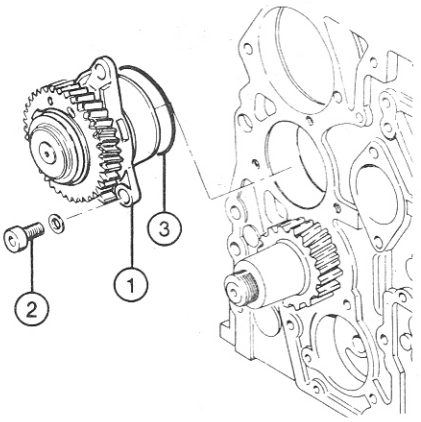
- **8.** Not applicable

- **10.** Remove the injection pump proceeding as described in Group 04 in the present publication.

- **14. Removal of front cover**

a. Unscrew the screws securing the cover to the engine block; then remove the cover and the crankshaft seal ring.

- **19d.** Remove vacuum pump (1) after slackening and removing relevant securing screws (2); keep underlying seal ring (3).



1. Vacuum pump
2. Vacuum pump securing screws
3. Seal ring

SUBASSEMBLY OVERHAUL AT THE BENCH

Alfa 90 2.4 turbodiesel
Alfa 90 Super 2.4 turbodiesel
Alfa 75 2.0 turbodiesel

Refer to the procedures in the relevant chapter in the Workshop Manual for
turbodiesel 2.0 2.4 2.5
(PA346900000000)
As far as all control data are concerned, refer to chapter «Service Data and Specifications» in the present publication.

ENGINE UNIT REASSEMBLY

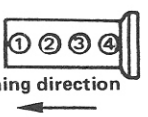
Alfa 90 2.4 turbodiesel
Alfa 90 Super 2.4 turbodiesel
Alfa 75 2.0 turbodiesel

Refer to the relevant chapter in the Workshop Manual for
turbodiesel 2.0 2.4 2.5
(PA346900000000)
When re-assembling and re-installing the engine, take into account the model modifications specified in paragraph «Dismantling of Engine Unit» in the present publication.
As far as all control data are concerned, refer to chapter «Service Data and Specifications» in the present publication.

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

ENGINE

Features		Engines	
		2000	2400
		VM 80 A	VM 81 A
Cycle		4 - Stroke Diesel	
Number of cylinders and arrangement		4 in line	
Cylinder identification			
Bore - Stroke Displacement	mm (in) cm^3 (cu.in)	88 x 82 (3.46 x 3.23) 1,995 (121.74)	92 x 90 (3.62 x 3.54) 2,393 (146.03)
Combustion chamber volume	cm^3 (cu. in)	23.2 to 24.3 (1.42 to 1.48)	28.16 to 29.66 (1.72 to 1.81)
Compression ratio		22	22
Power DIN Maximum Specific	kW (HP)	72.5 (97.15) 36.25 (48.58) at 4300 r.p.m.	80.9 (108.5) 33.83 (45.4) at 4200 r.p.m.
Max. torque DIN	N·m (kg·m; ft·lb)	193 (19.7; 142.4) at 2200 to 2400 r.p.m.	236 (24.1; 174.2) at 2300 r.p.m.
Piston mean speed (1)	m/s (ft/s)	11.75 (38.55)	12.6 (41.34)
Cylinder compression Specified value Max difference in pressure between cylinders	kPa (bar; kg/cm^2; p.s.i.)	2156 (21.56; 22; 312.9) 98 (0.98; 1; 14.2)	
Engine oil pressure (2) At idle r.p.m. At peak r.p.m.	kPa (bar; kg/cm^2; p.s.i.)	min. 49.03 (0.5; 7.1) 343.21 to 588.4 (3.43 to 5.88; 3.5 to 6; 49.8 to 85.3)	

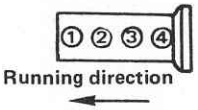
(1) At maximum power output r.p.m.

(2) Readings to be taken with engine at operating temperature (oil at 90°C; 194°F)

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

ENGINE

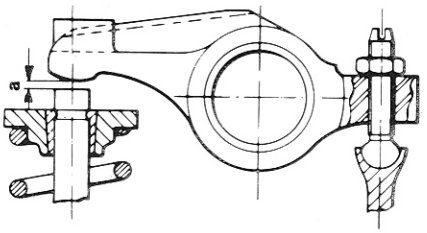
Features		Engines	
		2000	2400
		VM 80 A	VM 81 A
Cycle		4 - Stroke Diesel	
Number of cylinders and arrangement		4 in line	
Cylinder identification			
Bore - Stroke Displacement	mm (in) cm^3 (cu.in)	88 x 82 (3.46 x 3.23) 1,995 (121.74)	92 x 90 (3.62 x 3.54) 2,393 (146.03)
Combustion chamber volume	cm^3 (cu. in)	23.2 to 24.3 (1.42 to 1.48)	28.16 to 29.66 (1.72 to 1.81)
Compression ratio		22	22
Power DIN Maximum Specific	kW (HP)	72.5 (97.15) 36.25 (48.58) at 4300 r.p.m.	80.9 (108.5) 33.83 (45.4) at 4200 r.p.m.
Max. torque DIN	N·m (kg·m; ft·lb)	193 (19.7; 142.4) at 2200 to 2400 r.p.m.	236 (24.1; 174.2) at 2300 r.p.m.
Piston mean speed (1)	m/s (ft/s)	11.75 (38.55)	12.6 (41.34)
Cylinder compression Specified value Max difference in pressure between cylinders	kPa (bar; kg/cm^2; p.s.i.)	2156 (21.56; 22; 312.9) 98 (0.98; 1; 14.2)	
Engine oil pressure (2) At idle r.p.m. At peak r.p.m.	kPa (bar; kg/cm^2; p.s.i.)	min. 49.03 (0.5; 7.1) 343.21 to 588.4 (3.43 to 5.88; 3.5 to 6; 49.8 to 85.3)	

(1) At maximum power output r.p.m.

(2) Readings to be taken with engine at operating temperature (oil at 90°C; 194°F)

CHECKS AND ADJUSTMENTS

TIMING DATA (1)



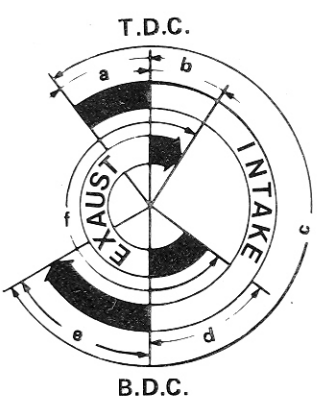
Unit: mm (in)

		Engines	
		2000	2400
		VM 80 A	VM 81 A
Camshaft	Alfa Romeo Part No.	162.06.03.200.00	
Normal valve clearance "a"	Intake	0.30 (0.012)	
	Exhaust	0.30 (0.012)	
Normal cam lift	Intake	7.20 (0.283)	
	Exhaust	7.64 (0.301)	

(1) All values refer to cold engine

TIMING DIAGRAM (ANGULAR VALUES) (1)

(camshaft clockwise rotation, viewed from front side)

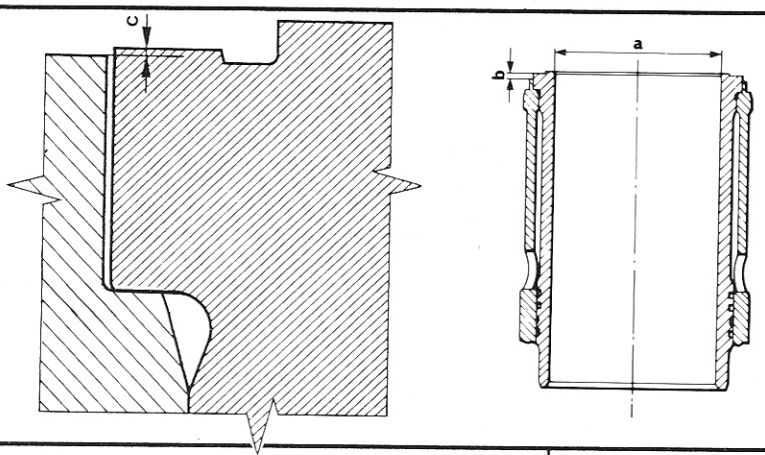


				Engines	
				2000	2400
				VM 80 A	VM 81 A
Normal diagram	Intake	Opens (B.T.D.C.)	"a"	22° ± 5°	
		Closes (A.B.D.C.)	"e"	48° ± 5°	
		Intake phase angle	"c"	250°	
	Exhaust	Opens (B.B.D.C.)	"d"	60° ± 5°	
		Closes (A.T.D.C.)	"b"	24° ± 5°	
		Exhaust phase angle	"f"	264°	
Diagram for timing check	Intake	Clearance for checking	mm (in)	1.2 (0.047)	
		Opens (A.T.D.C.)		4° ± 2°	
		Closes (A.B.D.C.)		18° ± 3°	
	Exhaust	Clearance for checking	mm (in)	1.65 (0.065)	
		Opens (B.B.D.C.)		26° ± 3°	
		Closes (B.T.D.C.)		10° ± 2°	

(1) All values refer to cold engine

CYLINDER LINERS, COMPRESSION RINGS, GUDGEON PINS AND PISTONS

Cylinder liners

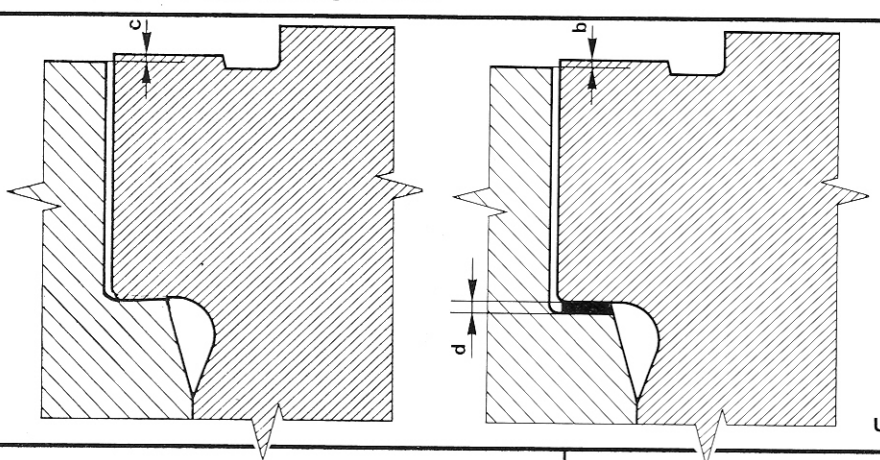


Unit: mm (in)

Inspection data		Engines	
		2000	2400
		VM 80 A	VM 81 A
Liner bore "a"	Grade A	88.000 to 88.010 (3.4646 to 3.4650)	92.000 to 92.010 (3.6220 to 3.6224)
	Grade B	88.010 to 88.020 (3.4650 to 3.4654)	92.010 to 92.020 (3.6224 to 3.6228)
Recess of cylinder liner outer rim from engine block (1) "c"		0.11 to 0.23 (0.0043 to 0.0091)	
Liner stand-out "b" from engine block (1)		0.00 to 0.05 (0 to 0.002)	
Max liner ovality and taper (at wear limit)		0.010 (0.0004)	
Liner inner surface roughness (new)	μ (in 10^{-3})	0.8 to 1.2 (0.03 to 0.05)	

(1) For this measurement, fit liner retaining tool A.7.0411 and tighten screws to 59 N·m (6 kg·m) (43.38 ft·lb)

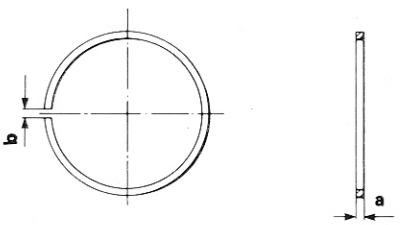
Measurement of gasket thickness between liner and engine block



Unit: mm (in)

Recess of cylinder liner outer rim from engine block "c"	Engines	
	2000	2400
	VM 80 A	VM 81 A
	Gasket "d" thickness	
0.11 to 0.14 (0.0043 to 0.0055)	0.15 (0.0059)	
0.15 to 0.20 (0.0059 to 0.0079)	0.20 (0.0079)	
0.21 to 0.23 (0.0083 to 0.0091)	0.23 (0.0091)	

Compression rings

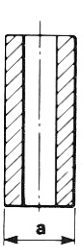


Unit: mm (in)

Inspection data		Engines	
		2000	2400
		VM 80 A	VM 81 A
Ring thickness "a"	1st compression ring	2.075 to 2.095 (0.0817 to 0.0825)	
	2nd compression ring	1.978 to 1.990 (0.0779 to 0.0783)	
	Oil scraper ring	3.978 to 3.990 (0.1566 to 0.1571)	
Ring gap (1) "b"	1st compression ring	0.300 to 0.500 (0.0118 to 0.0197)	0.40 to 0.65 (0.0157 to 0.0256)
	2nd compression ring	0.300 to 0.500 (0.0118 to 0.0197)	0.25 to 0.45 (0.0098 to 0.0177)
	Oil scraper ring	0.250 to 0.400 (0.0098 to 0.0157)	0.25 to 0.58 (0.0098 to 0.0228)

(1) To be measured by ring gauge or in cylinder liner

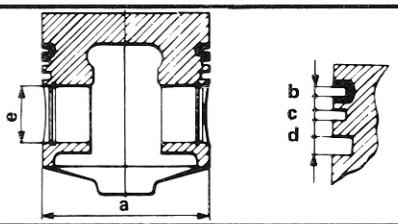
Gudgeon pins



Unit: mm (in)

Inspection data		Engines	
		2000	2400
		VM 80 A	VM 81 A
Gudgeon pin diameter "a"	Grade A	29.990 to 29.993 (1.1807 to 1.1808)	
	Grade B	29.993 to 29.996 (1.1808 to 1.1809)	

Pistons (with insert)

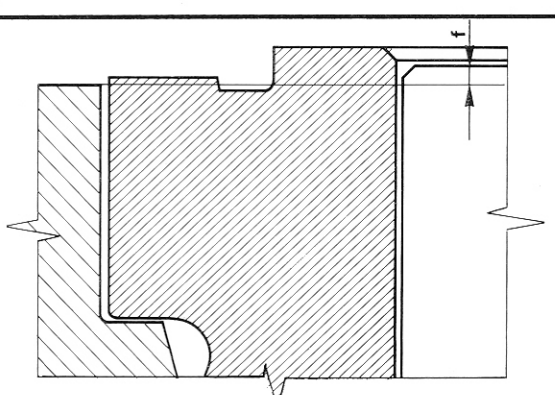


Unit: mm (in)

Inspection data		Engines	
		2000	2400
		VM 80 A	VM 81 A
Piston diameter (1) "a"	Grade A	87.965 to 87.975 (3.4632 to 3.4636)	91.965 to 91.975 (3.6206 to 3.6211)
	Grade B	87.975 to 87.985 (3.4636 to 3.4640)	91.975 to 91.985 (3.6211 to 3.6215)
1st compression ring groove height "b"		2.175 to 2.205 (0.0856 to 0.0868)	
2nd compression ring groove height "c"		2.040 to 2.060 (0.0803 to 0.0811)	2.060 to 2.080 (0.0811 to 0.0819)
Oil scraper ring groover height "d"		4.030 to 4.050 (0.1587 to 0.1595)	4.020 to 4.040 (0.1583 to 0.1591)
Gudgeon pin bore dia. in piston "e"	Grade A	29.999 to 30.002 (1.1811 to 1.1812)	
	Grade B	30.002 to 30.005 (1.1812 to 1.1813)	
Piston stand-out above liner at T.D.C. (2) "f"		0.680 to 0.970 (0.0268 to 0.0382)	0.500 to 0.750 (0.0197 to 0.0295)
Max piston skirt wear limit		0.050 (0.002)	
Max gudgeon pin bore ovality (at wear limit)		0.050 (0.002)	

(1) To be measured perpendicularly to gudgeon pin, at 19.75 mm (0.7775 in) from lower edge of piston skirt
(2) For this measurement, fit liner retaining tool A.7.0411 and tighten screws to 59 N·m (6 kg·m; 43.38 ft·lb)

Measurement of cylinder head gasket thickness

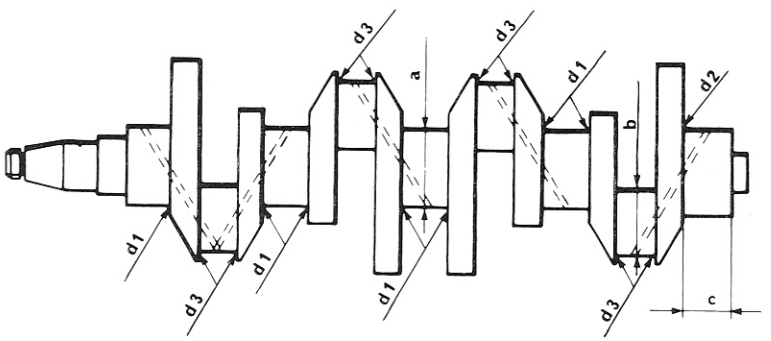


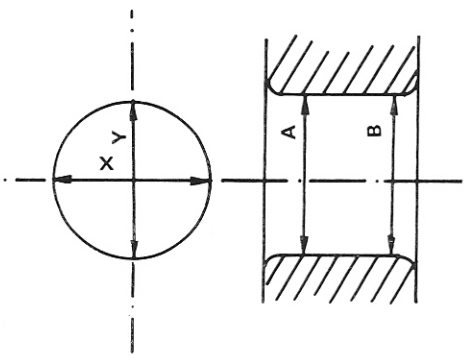
Unit: mm (in)

Cylinder head gasket thickness	Engines	
	2000	2400
	VM 80 A	VM 81 A
	Piston projection at T.D.C. from engine block "f"	
1.420 (0.0559)	0.680 to 0.770 (0.0268 to 0.0303)	0.500 to 0.570 (0.0197 to 0.0224)
1.520 (0.0598)	0.780 to 0.870 (0.0307 to 0.0343)	0.580 to 0.670 (0.0228 to 0.0264)
1.620 (0.0638)	0.880 to 0.970 (0.0346 to 0.0382)	0.680 to 0.750 (0.0268 to 0.0295)

CRANKSHAFT, CYLINDER BLOCK AND MAIN BEARINGS, CONNECTING RODS, BIG END BEARING AND FLYWHEEL

Crankshaft





Ovality X-Y

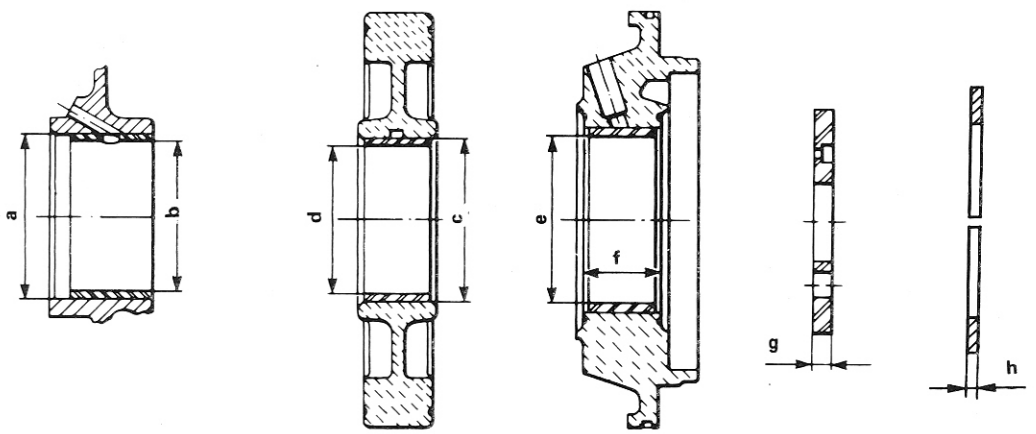
Taper A-B

Unit: mm (in)

Inspection data				Engines	
				2000	2400
				VM 80 A	VM 81 A
Main journal diameter "a"	Front and intermediate	Standard		62.980 to 63.000 (2.4795 to 2.4803)	
		Undersize	1st	62.730 to 62.750 (2.4697 to 2.4705)	
			2nd	62.480 to 62.500 (2.4598 to 2.4606)	
	Rear	Standard		69.980 to 70.000 (2.7551 to 2.7559)	
		Undersize	1st	69.730 to 69.750 (2.7453 to 2.7460)	
			2nd	69.480 to 69.500 (2.7354 to 2.7362)	
Crankpin diameter "b"		Standard		53.920 to 53.940 (2.1228 to 2.1236)	
		Undersize	1st	53.670 to 53.690 (2.1130 to 2.1138)	
			2nd	53.420 to 53.440 (2.1031 to 2.1039)	
Rear main journal length "c"				37.975 to 38.025 (1.4951 to 1.4970)	
Fillets	Front and intermediate main journals		"d_1"	2.7 to 3 (0.1063 to 0.1181)	
	Rear main journals		"d_2"	2.5 (0.0984)	
	Crankpins		"d_3"	2.7 to 3 (0.1063 to 0.1181)	
Main journal and crankpin surface roughness			μ (in 10^{-3})	0.12 (0.0047)	
Max. main journal and crankpin ovality at wear limit				0.010 (0.00039)	
Max. main journal and crankpin taper at wear limit				0.10 (0.0039)	
Max. main journal eccentricity				0.05 (0.0020)	

Note: Renitride crankshaft after grinding.

Cylinder block and main bearings



Unit: mm (in)

Inspection data			Engines	
			2000	2400
			VM 80 A	VM 81 A
Front bearing housing bore dia. "a" in engine block			67.025 to 67.050 (2.6388 to 2.6398)	
Front bearing housing bore dia. "b" in bearing split rings	Standard		63.060 to 63.110 (2.4826 to 2.4846)	
	Undersize	1st	62.810 to 62.860 (2.4728 to 2.4748)	
		2nd	62.560 to 62.610 (2.4630 to 2.4650)	
Intermediate bearing housing bore dia. "c" in bearing split rings (1)			66.670 to 66.687 (2.6248 to 2.6255)	
Intermediate bearing inner dia. "d" in bearing split rings (2)	Standard		63.050 to 63.093 (2.4823 to 2.4840)	
	Undersize	1st	62.800 to 62.843 (2.4724 to 2.4741)	
		2nd	62.550 to 62.593 (2.4626 to 2.4643)	
Rear bearing inner dia. "e" in bearing split ring	Standard		70.060 to 70.085 (2.7583 to 2.7593)	
	Undersize	1st	69.810 to 69.835 (2.7484 to 2.7494)	
		2nd	69.560 to 69.585 (2.7386 to 2.7395)	
Rear bearing housing shoulder distance "f"			33.060 to 33.130 (1.3016 to 1.3043)	
Crankshaft abutment flange thickness "g"			7.90 to 8.10 (0.3110 to 0.3189)	
Shim rings thickness "h"	Standard		2.311 to 2.362 (0.0909 to 0.0930)	
	Oversize	1st	2.411 to 2.462 (0.0949 to 0.0969)	
		2nd	2.511 to 2.562 (0.0988 to 0.1008)	

(1) For this measurement, fit liner retaining tool A.7.0411 and tighten screws to 59 Nm (6 kgm) (43.38 ft·lb)
(2) To be measured with bearing split ring screws tightened to 39 to 44 Nm (4 to 4.5 kgm) (28.92 to 32.54 ft.lb)

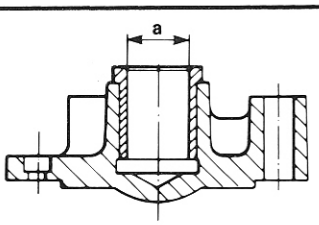
Connecting rods and big end bearing

Unit: mm (in)

Inspection data			Engines	
			2000	2400
			VM 80 A	VM 81 A
Connecting rod small end bearing bore "a"			30.030 to 30.045 (1.1823 to 1.1829)	
Connecting rod small end bearing outside diameter "b"			34.089 to 34.129 (1.3421 to 1.3437)	
Bush housing inner dia. "c" in small end			34.000 to 34.025 (1.3386 to 1.3397)	
Big end inner dia. "d" (1)			57.563 to 57.582 (2.2663 to 2.2670)	
Connecting rod big end bearing bore (1) "e"	Normal		53.975 to 54.014 (2.1250 to 2.1265)	
	Undersize	1st	53.725 to 53.764 (2.1152 to 2.1167)	
		2nd	53.475 to 53.514 (2.1053 to 2.1068)	

(1) To be measured with connecting rod screws tightened to 79.4 to 84.3 Nm (8 to 8.6 kgm) (57.84 to 62.18 ft.lb)

Flywheel

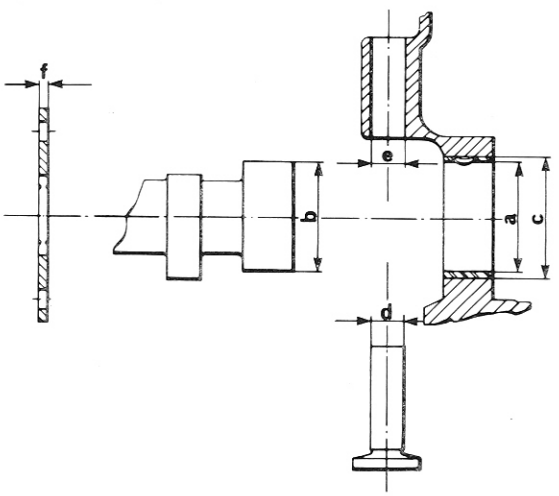


Unit: mm (in)

Inspection data			Engines	
			2000	2400
			VM 80 A	VM 81 A
Flywheel centre bush bore	"a"	Boring	26.010 to 26.023 (1.0240 to 1.0245)	

CAMSHAFT, TAPPETS, ROCKERS, SPRINGS, CYLINDER HEADS, VALVES AND OIL PUMP

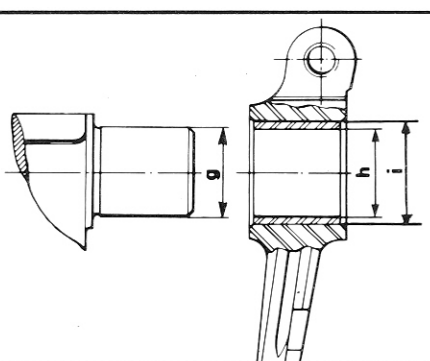
Camshaft and tappets



Unit: mm (in)

Inspection data	Engines	
	2000	2400
	VM 80 A	VM 81 A
Camshaft bearing bore dia. "a"	53.540 to 53.590 (2.1079 to 2.1098)	
Camshaft journal diameter "b"	53.480 to 53.500 (2.1055 to 2.1063)	
Camshaft bearing housing bore dia. "c"	57.005 to 57.030 (2.2443 to 2.2453)	
Tappet outer diameter "d"	14.965 to 14.985 (0.5892 to 0.5899)	
Tappet housing bore dia. in engine block "e"	15.010 to 15.035 (0.5909 to 0.5919)	
Camshaft flange thickness "f"	3.950 to 4.050 (0.1555 to 0.1594)	

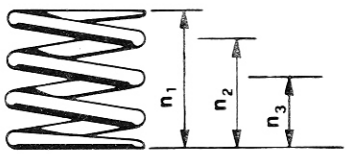
Rockers

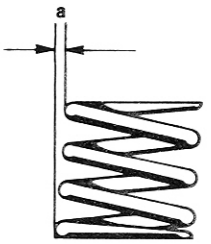


Unit: mm (in)

Inspection data	Engines	
	2000	2400
	VM 80 A	VM 81 A
Rocker shaft diameter "g"	21.979 to 22.000 (0.8653 to 0.8661)	
Rocker bush bore dia. "h"	22.020 to 22.041 (0.8669 to 0.8677)	
Rocker bush housing bore dia. "i" in rocker	25.000 to 25.033 (0.9843 to 0.9855)	

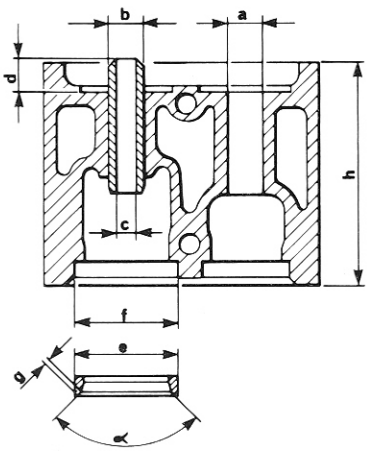
Springs





Inspection data		Engines	
		2000	2400
		VM 80 A	VM 81 A
Valve spring free length "n_1"	mm (in)	44.65 (1.758)	
Spring length "n_2" (valve closed)	mm (in)	38.6 (1.519)	
Load at length n_2	N (kg;lb)	323.7 to 343.3 (33 to 35; 72.75 to 77.16)	
Spring length "n_3" (valve open)	mm (in)	28.2 (1.110)	
Load at length n_3	N (kg;lb)	882.9 to 931.9 (90 to 95; 198.4 to 209.4)	
Max squareness error "a" of valve spring (free length)	mm (in)	1.2 (0.047)	

Cylinder heads

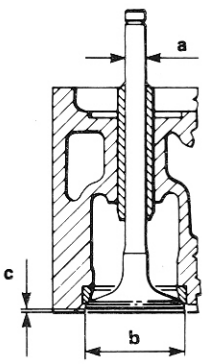


Unit: mm (in)

Inspection data			Engines	
			2000	2400
			VM 80 A	VM 81 A
Valve guide housing bore dia. "a"			13.992 to 14.008 (0.5508 to 0.5515)	
Valve guide outer dia. "b"			14.028 to 14.039 (0.5523 to 0.5527)	
Valve guide fitted inner dia. "c"			8.000 to 8.015 (0.3150 to 0.3155)	
Valve guide stand-out "d"			13.5 to 14 (0.532 to 0.551)	
Valve seat outer dia. "e"	Standard	Intake	42.070 to 42.086 (1.6563 to 1.6569)	
		Exhaust	36.050 to 36.066 (1.4193 to 1.4199)	
	Oversize	Intake	42.370 to 42.386 (1.6681 to 1.6687)	
		Exhaust	36.350 to 36.366 (1.4311 to 1.4317)	
Valve seat housing bore dia. "f"	Standard	Intake	41.962 to 41.985 (1.6520 to 1.6530)	
		Exhaust	35.964 to 35.988 (1.4159 to 1.4168)	
	Oversize	Intake	42.262 to 42.285 (1.6638 to 1.6648)	
		Exhaust	36.264 to 36.288 (1.4277 to 1.4287)	
Valve seat taper (1) "α"		Intake	110°	
		Exhaust	90°	
Valve seat mating surface length (1) "g"		Intake	1.50 (0.0590)	
		Exhaust	1.80 (0.0709)	
Cylinder head height "h"			89.95 to 90.05 (3.541 to 3.545)	

(1) Seat installed.

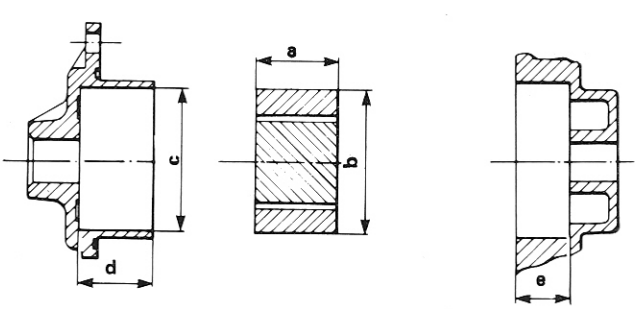
Valves



Unit: mm (in)

Inspection data		Engines	
		2000	2400
		VM 80 A	VM 81 A
Valve stem dia. "a"	Intake	7.940 to 7.960 (0.3126 to 0.3134)	
	Exhaust	7.920 to 7.940 (0.3118 to 0.3126)	
Valve head diameter "b"	Intake	40.05 to 40.25 (1.5768 to 1.5846)	
	Exhaust	33.80 to 34.00 (1.3307 to 1.3386)	
Valve stand in "c" in cylinder head	Intake	0.80 to 1 (0.0315 to 0.0394)	0.80 to 1.20 (0.0315 to 0.0472)
	Exhaust	0.80 to 1 (0.0315 to 0.0394)	0.79 to 1.19 (0.0311 to 0.0468)

Oil pump



Unit: mm (in)

Inspection data	Engines	
	2000	2400
	VM 80 A	VM 81 A
Oil pump rotor width "a"	32.487 to 32.500 (1.2790 to 1.2795)	
Pump outer rotor outer diameter "b"	57.975 to 58.000 (2.2825 to 2.2835)	
Rotor housing bore dia. "c" in pump body	58.105 to 58.130 (2.2876 to 2.2886)	
Rotor housing depth "d" in pump body	32.430 to 32.460 (1.277 to 1.278)	
Oil pump housing depth "e" in engine block	22.000 to 22.025 (0.8661 to 0.8671)	

FITMENT PLAYS AND INTERFERENCE FITS

Unit: mm (in)

Inspection data		Engines	
		2000	2400
		VM 80 A	VM 81 A
Cylinder bore/ piston clearance	New	0.025 to 0.045 (0.0010 to 0.0017)	
	Wear limit	0.5 (0.02)	
Ring/groove end float	1st compression ring	0.080 to 0.130 (0.0031 to 0.0051)	
	2nd compression ring	0.050 to 0.082 (0.0020 to 0.0032)	0.070 to 0.102 (0.0027 to 0.0040)
	Oil scraper ring	0.040 to 0.072 (0.0016 to 0.0028)	0.030 to 0.062 (0.0012 to 0.0024)
Pin/piston bore clearance		0.003 to 0.015 ((0.118 to 0.59)·10^{-3})	0.002 to 0.012 ((0.079 to 0.472)·10^{-3})
Pin small-end bush bore clearance	New	0.034 to 0.055 (0.0013 to 0.0021)	
	Wear limit	0.100 (0.0039)	
Main journal/bearing running clearance (new)	Rear main journal	0.06 to 0.130 (0.0024 to 0.0051)	0.060 to 0.105 (0.0024 to 0.0041)
	Front main journal	0.05 to 0.113 (0.0020 to 0.0044)	0.060 to 0.130 (0.0024 to 0.0051)
	Intermediate main journal	0.06 to 0.105 (0.0024 to 0.0041)	0.050 to 0.113 (0.0020 to 0.0044)
Big-end bearing crankpin running clearance (new)		0.035 to 0.094 (0.0014 to 0.0037)	
Main journal and crankpin/bearing running clearance (at wear limit)		0.200 (0.0079)	
Crankshaft end float		0.121 to 0.323 (0.0047 to 0.0127)	
Big-end end float		0.20 to 0.40 (0.0079 to 0.0157)	
Camshaft journal bearing running clearance	New	0.040 to 0.110 (0.0016 to 0.0043)	
	Wear limit	0.200 (0.0079)	
Rocker bush/shaft running clearance	New	0.020 to 0.062 (0.0008 to 0.0024)	
	Wear limit	0.200 (0.0079)	
Tappet/housing running clearance	New	0.025 to 0.070 (0.00098 to 0.00275)	
	Wear limit	0.100 (0.0039)	
Valve stem/guide running clearance	Intake	0.040 to 0.075 (0.0016 to 0.0029)	
	Exhaust	0.060 to 0.095 (0.0024 to 0.0037)	
Valve seat/housing interference fit	Intake	0.085 to 0.124 (0.0033 to 0.0049)	
	Exhaust	0.062 to 0.102 (0.0024 to 0.0040)	
Valve guide/housing interference fit		0.020 to 0.047 (0.0008 to 0.0018)	
Rotor stand-outs in oil pump		0.027 to 0.070 (0.0011 to 0.0027)	
Oil pump inner/outer rotor max. clearance		0.070 to 0.20 (0.0027 to 0.0079)	
Outer rotor/housing clearance in oil pump	New	0.150 to 0.155 (0.0059 to 0.0061)	
	Wear limit	0.150 to 0.155 (0.0059 to 0.0061)	
Gear end float in pump body		0.05 to 0.07 (0.0020 to 0.0027)	

WARM-UP TEMPERATURES

Unit: °C (°F)

Component	Temperature
Cylinder head temperature for valve installation	150 (302)
Cylinder head temperature for valve guide installation	80 to 90 (176 to 194)
Camshaft drive pinion temperature for installation on crankshaft	180 to 200 (356 to 392)
Drive gear temperature for installation on camshaft	180 to 200 (356 to 392)

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Q.ty kg (lb)
Crankshaft oil seals (front and rear)			
— Outside	OIL	AGIP SINT DIESEL 10W/40 IP SINTIAX TURBODIESEL 10W/40 SHELL MYRINA 15W/40	As required
— Sealing lip	GREASE	ISECO MOLYKOTE BR2 Std. No. 3671-69841	As required
Engine oil sump at max. level	OIL	AGIP SINT DIESEL 10W/40 IP SINTIAX TURBODIESEL 10W/40 SHELL MYRINA 15W/40	5.5 (12.12)
Filter			0.5 (1.1)
Engine oil and filter periodic change			6 (13.23)
Difference between minimum and maximum oil level on dipstick			2.5 (5.51)
Threading — Screws securing head to engine block — Connecting rod cap retaining screws — Rocker shaft bracket retaining nuts	LUBRICANT	MOLIGUARD LMP/180	As required

SEALANTS AND FIXING AGENTS

Application	Type	Denomination	Q.ty
Oil sump gasket, engine block side (1)	SEALING COMPOUND	DOW CORNING Silastik 732 RTV Std. No. 3522-00040	As required
Liner/engine block upper contact face (1)	SEALING COMPOUND	LOCTITE AVX 986 Std. No. 3524-00012	As required

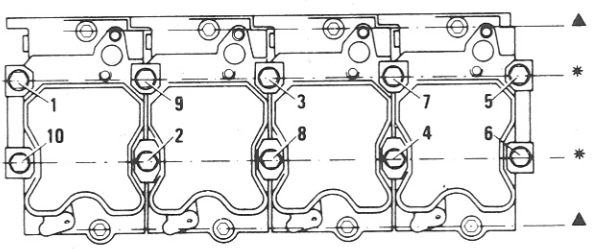
(1) Before application completely remove all traces of old compound and remove grease from the surfaces with trichloroethylene or trichloroethane

ABRASIVES

Application	Type	Denomination	Q.ty
Valve and seat grinding-in	GRINDING PASTE	SIPAL AREXONS: Carbon-silicon for valves Std. No. 4100-31502	As required

TIGHTENING TORQUES

Unit: N·m (kg·m; ft·lb)

Item	Engines	
	2000	2400
	VM 80 A	VM 81 A
Crankshaft centre bearing split ring screws (with engine oil)	39 to 44 (4 to 4.5; 28.9 to 32.5)	
Rear crankshaft bearing retaining nuts	24.5 to 29.4 (2.5 to 3; 18.1 to 21.7)	
Flywheel to crankshaft securing screws (with engine oil)	107.8 (11; 79.5)	
Connecting rod cap retaining screws (lubricate with MOLIGUARD LMP/180)	79.4 to 84.3 (8 to 8.5; 57.8 to 62.2)	
Front crankshaft pulley retaining nut (with engine oil)	147 to 156.8 (15 to 16; 108.5 to 115.7)	
Screws securing cylinder heads to engine block (with lubricant MOLIGUARD LMP/180) Tightening sequence of the screws securing cylinder heads to engine block a. Using a torque wrench, tighten inner screws (*) to a torque of **29 N·m (3 kg·m; 21.4 ft·lb)** in the order indicated in the diagram. b. Check all inner screws (*) for tightening (operation just accomplished). c. Using box wrench **A.5.0271** provided with goniometer **A.2.0447**, additionally tighten inner screws (*) accomplishing a 50° revolution. Comply with the order indicated in the diagram. d. Accomplish another 50° angle tightening operation in relation to inner screws (*). Comply with the order indicated in the diagram. e. Then, using a torque wrench, tighten outer screws (▲) to a torque of **88 N·m (9 kg·m; 64.9 ft·lb)**; no particular order is required. f. Upon completion of the installation operations, start the engine and let it idle for about 20 minutes. Then stop the engine, let it cool, and when the **engine is cold** tighten again proceeding as hereinafter specified: - Using a box wrench provided with a goniometer, accomplish a 30° angle tightening operation in relation to inner screws (*) in order specified in the diagram. - Using a torque wrench, slacken outer screws (▲) by 30° and then tighten them to a torque of **88 N·m (9 kg·m; 64.9 ft·lb)**; no particular order is required.		
Rocker shaft bracket retaining nuts (lubricate with MOLIGUARD LMP/40)	107.8 (11; 79.5)	
Oil pump retaining screws (with engine oil)	24.5 to 29.4 (2.5 to 3; 18.1 to 21.7)	
Front cover retaining screws (with engine oil)	11.7 (1.2; 8.7)	
Screws securing water pump to engine block (with engine oil)	24.5 (2.5; 18.1)	
Water temperature indicator transmitter on inlet manifold	49 (5; 36.1)	
Fan temperature switch	20 to 25 (2 to 2.5; 14.5 to 18.1)	
Engine oil thermostat (with engine oil)	68.6 to 78.4 (7 to 8; 50.61 to 57.84)	

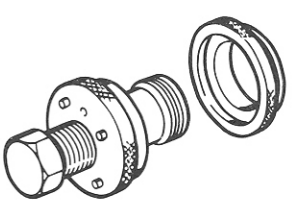
TROUBLE DIAGNOSIS AND CORRECTIONS

Refer to the relevant chapter in the Workshop Manual for turbodiesel 2.0 2.4 2.5 (PA346900000000)

SPECIAL SERVICE TOOLS

Refer to the relevant chapter in the Workshop Manual for turbodiesel 2.0 2.4 2.5 (PA346900000000) apart from what hereinafter specified:

- As for Alfa 90 Super 2.4 turbodiesel tool **A.7.0384** is replaced with tool **A.3.0612**.

A.3.0612	Tool for removal of engine front cover plug, injection pump puller	

GROUP 04

CONTENTS

04

(*) Refer to: Alfa 90 "WORKSHOP MANUAL"
PA360500000000 **GROUP 00 — Engine Maintenance**

DESCRIPTION

FUEL SUPPLY SYSTEM

The fuel system uses indirect injection into the high turbulence pre-combustion chamber; it is composed of:

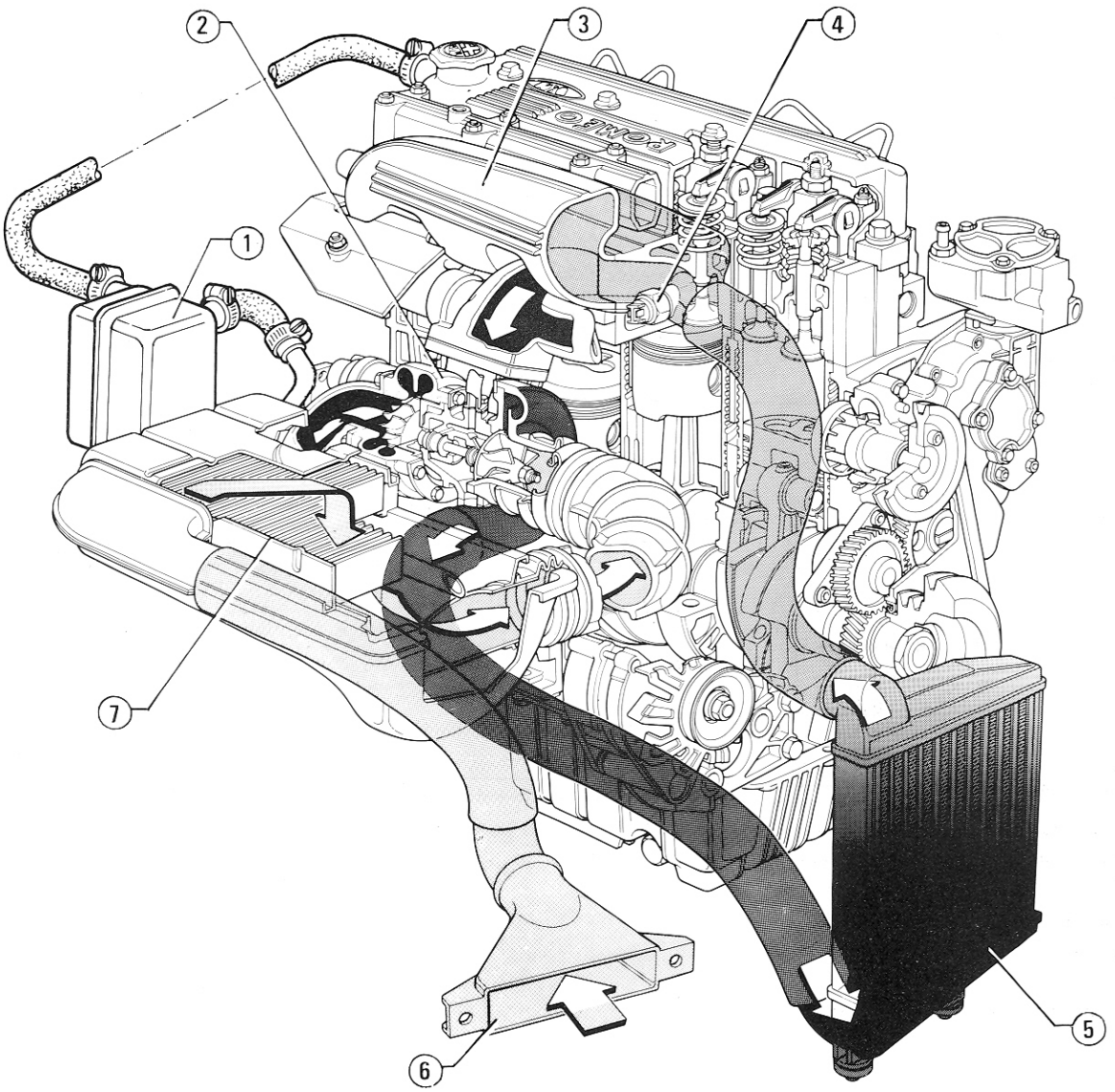
- Rotary injection pump of the BOSCH single-piston rotary type, and mechanical regulator for the minimum and peak r.p.m.
- Regulating valve internal to the injection pump; its purpose is to keep constant the pressure of the fuel delivered to injectors, and to send back the excess fuel to tank.
- Pneumatic capsule on the injection pump; it serves to regulate fuel delivery to injectors in relation to the supercharging air pressure.
- Injection automatic advance device, in relation to the supply pressure.
- Cold start-up device for advance automatic adjustment, in relation to coolant temperature.
- R.p.m. - activated microswitch to deactivate the pre-heating glow plugs when the accelerator control lever performs a travel greater than **5.5 mm (0.2165 in)**, corresponding to an engine speed exceeding **1300 to 1900 r.p.m.**, before timer has by-passed the supply to glow-plugs.
- Electric-stop valve, for interrupting the fuel supply when engine is switched off.
- Needle spray-nozzle injectors.
- Mechanical fuel supply pump, operated by an auxiliary cam of camshaft.

SUPERCHARGING SYSTEM

This system is composed of:

- Exhaust gas turbocharger fitted with waste gate valve which starts operating when engine reaches **2,600 r.p.m.**, corresponding to the max supercharging value.
- Heat exchanger (intercooler), located on vehicle front side; its purpose is to refrigerate the compressed air, in order to increase the engine volumetric efficiency.

SUPERCHARGING SYSTEM

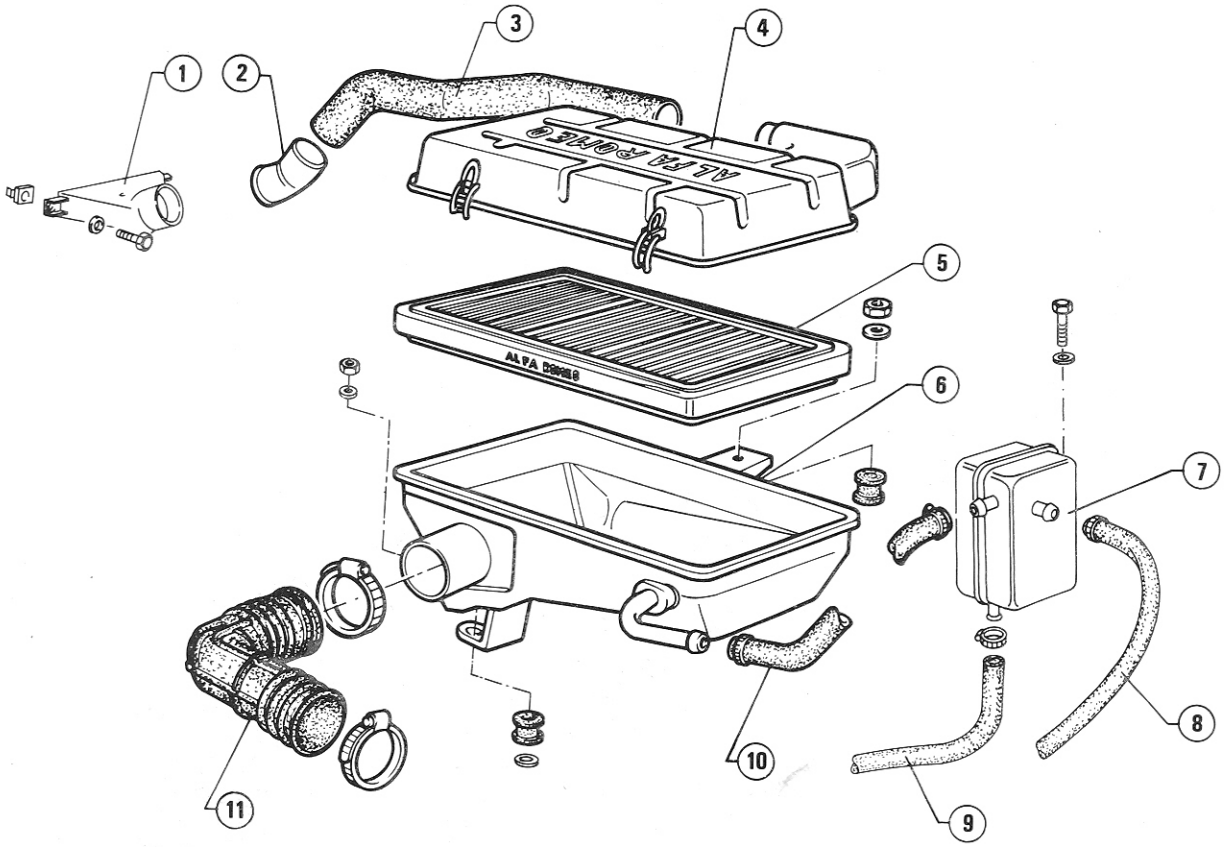


Outside air
Compressed air
Cooled air
Exhaust gases

1 Oil vapour sedimenter
2 Turbocharger
3 Intake manifold
4 Supercharging air pressure sensor
5 Intercooler
6 Air intake
7 Air filter

CAUTION:
After having reassembled the air supply system components, verify system tightness after turbocharger.

AIR FILTER



1 Air intake
2 Union
3 Sleeve
4 Air filter cover
5 Filtering element
6 Air filter casing
7 Oil vapour sedimenter
8 Oil vapour breather hose
9 Oil return hose
10 Oil vapour return hose
11 Air-to turbocharger delivery corrugated sleeve

REMOVAL

Remove the air filter body, complete with filtering element, operating as follows:

1. Detach sleeve (2) from air filter cover (3).
2. Release the four clips securing cover (3), and remove it. Remove also filtering element (4).
3. Detach sleeve (10) and hose (9) from casing (5).
4. Unscrew the three nuts which secure casing, and remove it from body.

CHECKS AND INSPECTIONS

Thoroughly clean the filtering element by blowing low-pressure compressed air. If required, replace the filtering element.

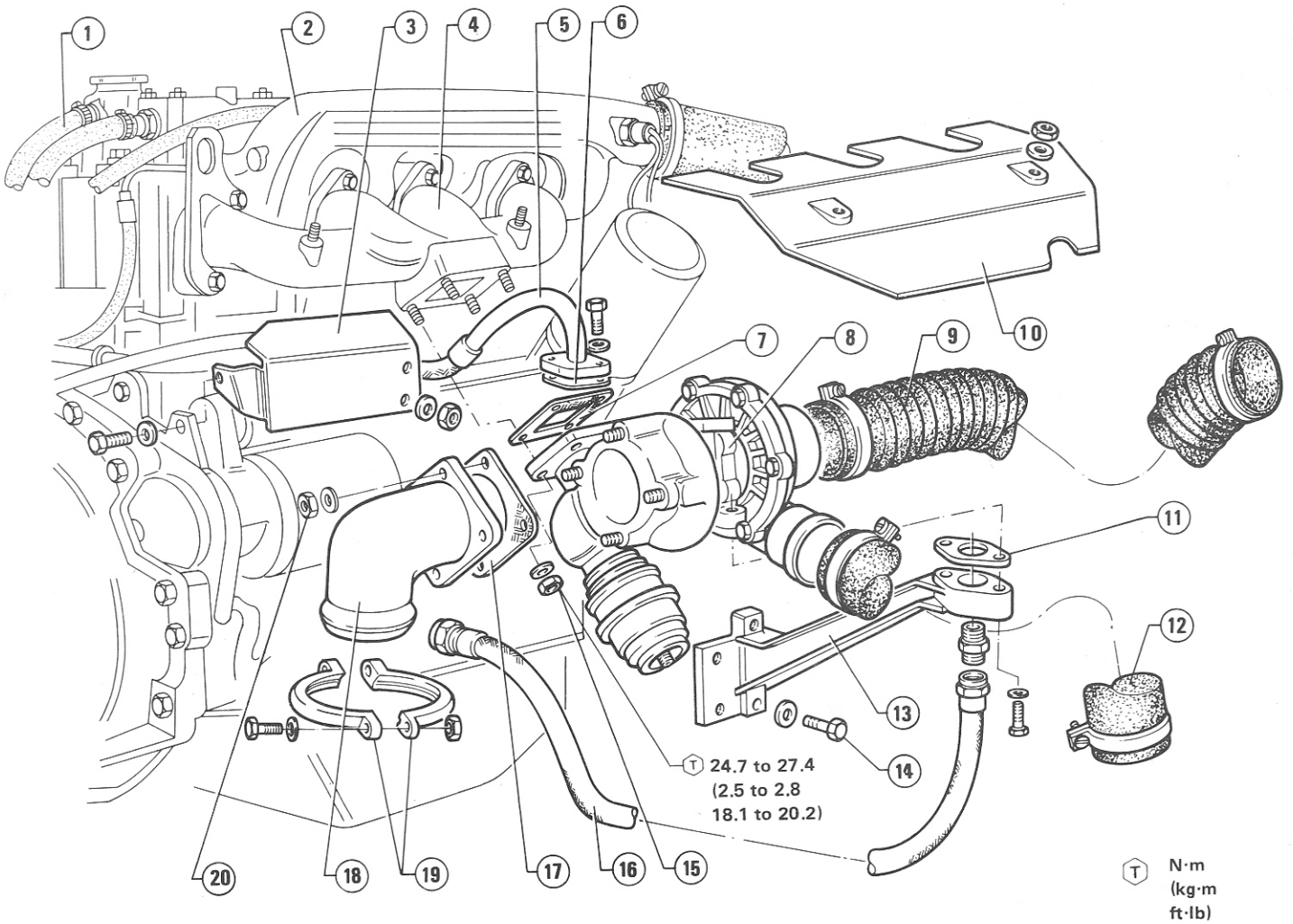
INSTALLATION

Install air filter by reversing the order of removal.

- Position the filtering element on filter casing; according to the mark situated on the side of the element indicating its top part (the arrow marked on filtering element side must be downward).

TURBOCHARGER

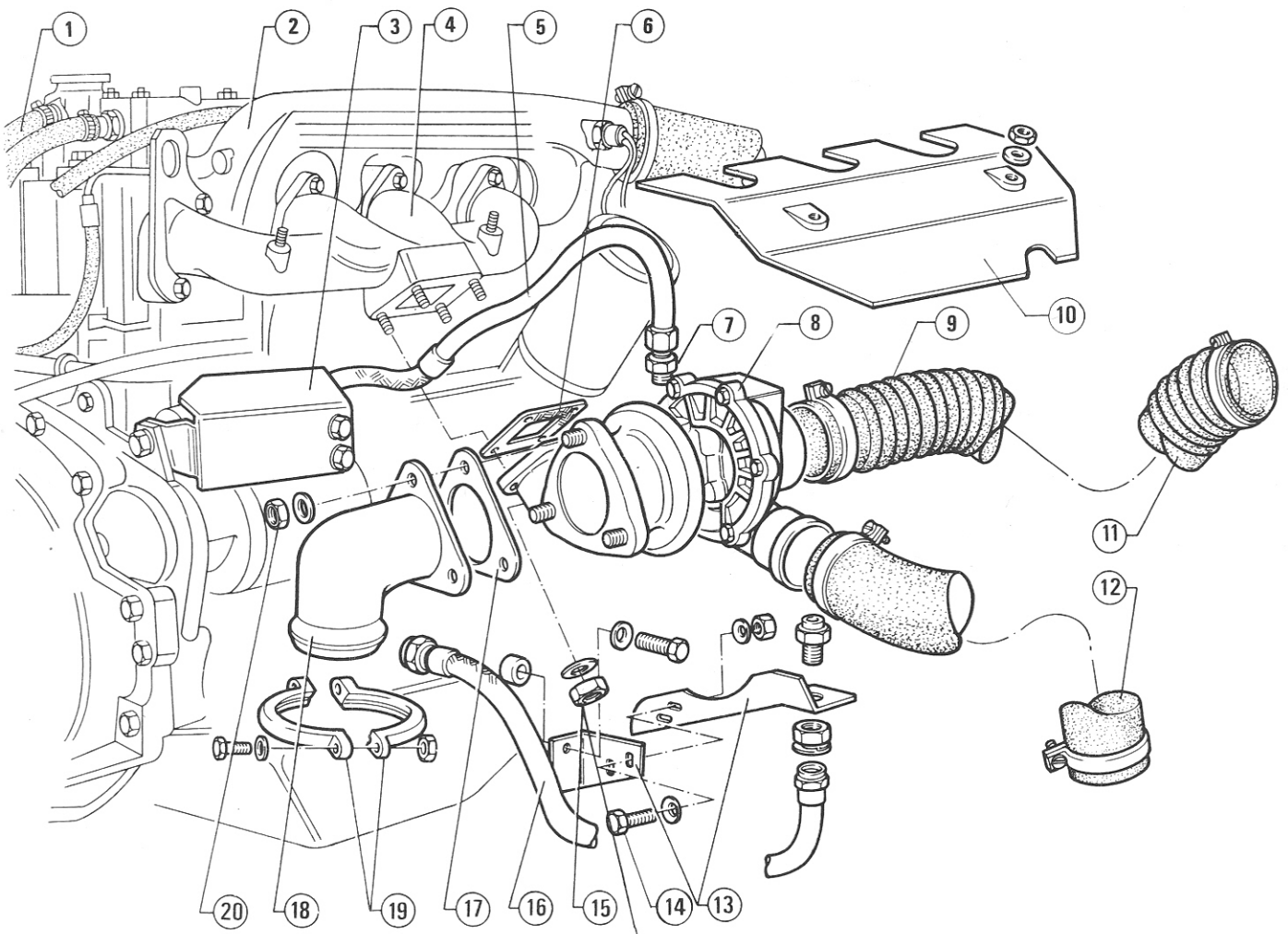
Alfa 90 2.4 turbodiesel



1 Oil vapour breather hose
2 Air supply manifold
3 Starter cover
4 Exhaust manifold
5 Oil-to turbocharger delivery hose
6 Gasket
7 Gasket
8 Turbocharger
9 Air-to turbocharger delivery sleeve
10 Thermal shield
11 Gasket
12 Air-to intercooler delivery sleeve
13 Turbocharger support
14 Screw securing support to engine block
15 Nut
16 Oil return hose from turbocharger
17 Gasket
18 Exhaust gas union
19 Collar
20 Nut

Alfa 75 2.0 turbodiesel

Alfa 90 Super 2.4 turbodiesel



1 Oil vapour breather hose
2 Air supply manifold
3 Starter cover
4 Exhaust manifold
5 Oil-to turbocharger delivery hose
6 Gasket
7 Union
8 Turbocharger
9 Air-to turbocharger delivery sleeve
10 Thermal shield
11 Gasket
12 Air-to intercooler delivery sleeve
13 Turbocharger support
14 Screw securing support to engine block
15 Nut
16 Oil return hose from turbocharger
17 Gasket
18 Exhaust gas union
19 Collar
20 Nut

REMOVAL

1. Open the bonnet and support it with the support rod provided. Remove the bolts securing hinges, then open bonnet completely.

WARNING:
For maximum safety, the bonnet should be kept in position using the method the operator considers most suitable.
Proceed with care if working on a hot engine to avoid being burned.

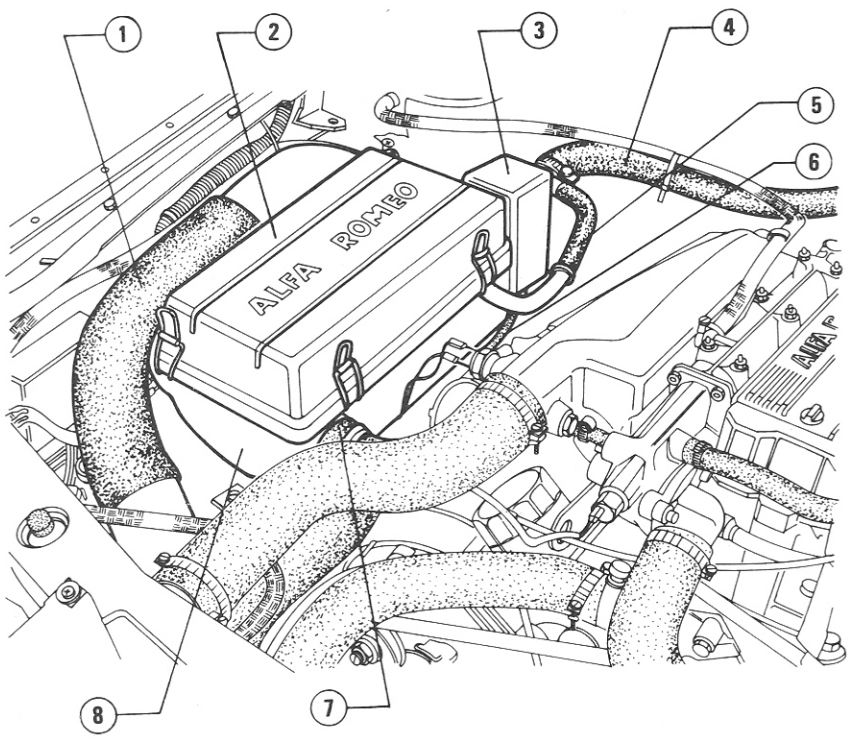
2. Disconnect the battery negative terminal.

3. Operating from vehicle right-hand side, disconnect the following hoses and sleeves, and remove them from the indicated part.
- Sleeve (1), from air intake
- Sleeve (7), from turbocharger
- Hose (5), from air filter casing

4. Release the securing clips, and remove air filter cover (2) and filtering element.

5. Unscrew the nuts securing air filter casing (8) and remove it.

6. Unscrew the securing screws of oil vapour sedimenter (3), and move it to the engine compartment rear side, to facilitate turbocharger removal.



1 Air-to filter delivery sleeve
2 Air filter cover
3 Oil vapour sedimenter
4 Oil vapour breather hose
5 Oil vapour return hose
6 Oil return hose
7 Delivery sleeve to turbocharger
8 Air filter casing

For the following steps, refer to the exploded view of page 04-5 for **Alfa 90 2.4 turbodiesel** *and page 04-5/1 for* **Alfa 75 2.0 turbodiesel** *and* **Alfa 90 Super 2.4 turbodiesel** *respectively.*

7. Disconnect sleeve (12) from turbocharger.

8. Unscrew the nuts securing thermal shield (10), and remove it from exhaust manifold.

9. Disconnect union of hose (5) for oil delivery to turbocharger, from turbocharger itself.

10. Unscrew the union of hose (16) for oil return from turbocharger to engine block; detach hose from turbocharger.

11. Remove collar (19) connecting the exhaust gas union, on turbocharger, to exhaust pipe.

12. Unscrew nuts (15) securing turbocharger to exhaust manifold (4). Unscrew the two screws securing turbocharger support (13). Remove the complete turbocharger unit (8) withdrawing it from the studs on exhaust manifold.

13. Unscrew the four nuts (20) securing exhaust gas union to turbocharger (18); remove union by withdrawing it from turbocharger studs.

CHECKS AND INSPECTIONS

Refer to: **Alfa 90** "WORKSHOP MANUAL - Group 00 - Engine Maintenance **2.4 turbodiesel** Engine Fuel System - Check of End Play and Running Clearance of Turbocharger Rotor Shaft and By-pass Valve".

INSTALLATION

For the following steps, refer to the figure of page 04-5 for **Alfa 90 2.4 turbodiesel** *and page 04-5/1 for* **Alfa 75 2.0 turbodiesel** *and* **Alfa 90 Super 2.4 turbodiesel** *respectively.*

1. Install the exhaust gas union (18), with the related gasket (17), on turbocharger; secure union with the related nuts.

2. Install turbocharger unit (8) on engine, inserting it on the studs of exhaust manifold, interposing a new gasket (7).

3. Insert without tightening the four nuts (15) securing turbocharger to exhaust manifold.

4. Secure support (13) to engine block, tightening the related screws, then tighten nuts (15) to the prescribed torque.

(T) : **Tightening torque**
Nuts securing turbocharger (in oil)
24.7 to 27.4 N·m
(2.5 to 2.8 kg·m;
18.1 to 20.2 ft·lb)

5. Reconnect the oil - to - engine block return hose (16) locking the related union to turbocharger.

6. Fill compressor body with engine oil, in order to ensure lubrication in the first functioning phase;

7. Reconnect the oil - to turbocharger delivery hose (5).

For Alfa 90 2.4 turbodiesel, interpose a new gasket (6) between hose (5) union and the related housing on turbocharger.

8. Reconnect the exhaust gas union to the exhaust pipe, tightening collar (19).

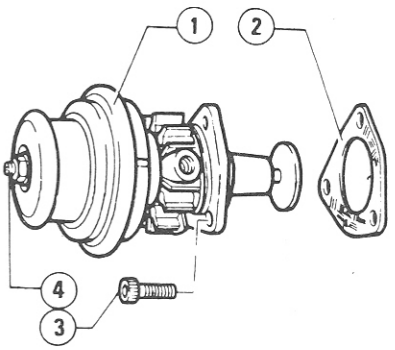
9. Complete the installation by reversing the order of removal.

BY PASS VALVE

If, when carrying out the diagnosis procedure related to incorrect functioning of the overpressure system, the turbocharger by-pass valve replacement is required, operate as follows.

1. Remove turbocharger (Refer to: Turbocharger - Removal).

2. Unscrew screws (3) securing the valve, and remove it together with gasket (2).



1 Waste gate valve
2 Gasket
3 Screw
4 Pressure regulating screw

3. Should signs of seizing be present on valve stem or breakage of seal device or of spring, replace the valve assembly.

The by-pass valve is calibrated at firm; consequently, no adjustment is required during servicing.

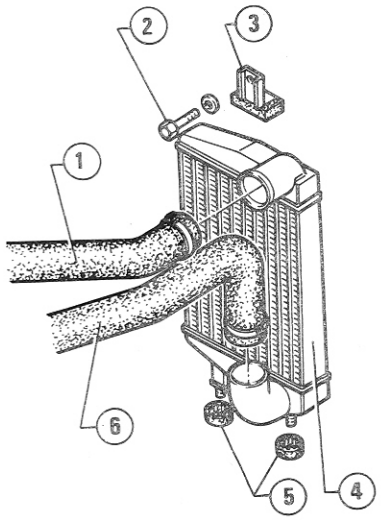
4. Reconnect at the by-pass valve to turbocharger unit, interposing a new gasket.

5. Reconnect turbocharger (Refer to: Turbocharger - Installation).

INTERCOOLER

REMOVAL AND INSTALLATION

1. Open the bonnet and support it with the support rod provided.
2. Drain coolant radiator (refer to: Group 07 - Radiator - Removal and Installation).
3. Unscrew the central securing screw of radiator cover and remove it from clamps.
4. Detach sleeves (1) and (6) from intercooler (4) and turbocharger, respectively.
5. Unscrew screw (2), remove bracket (3) and withdraw intercooler from front side, recovering rubber pads (5).



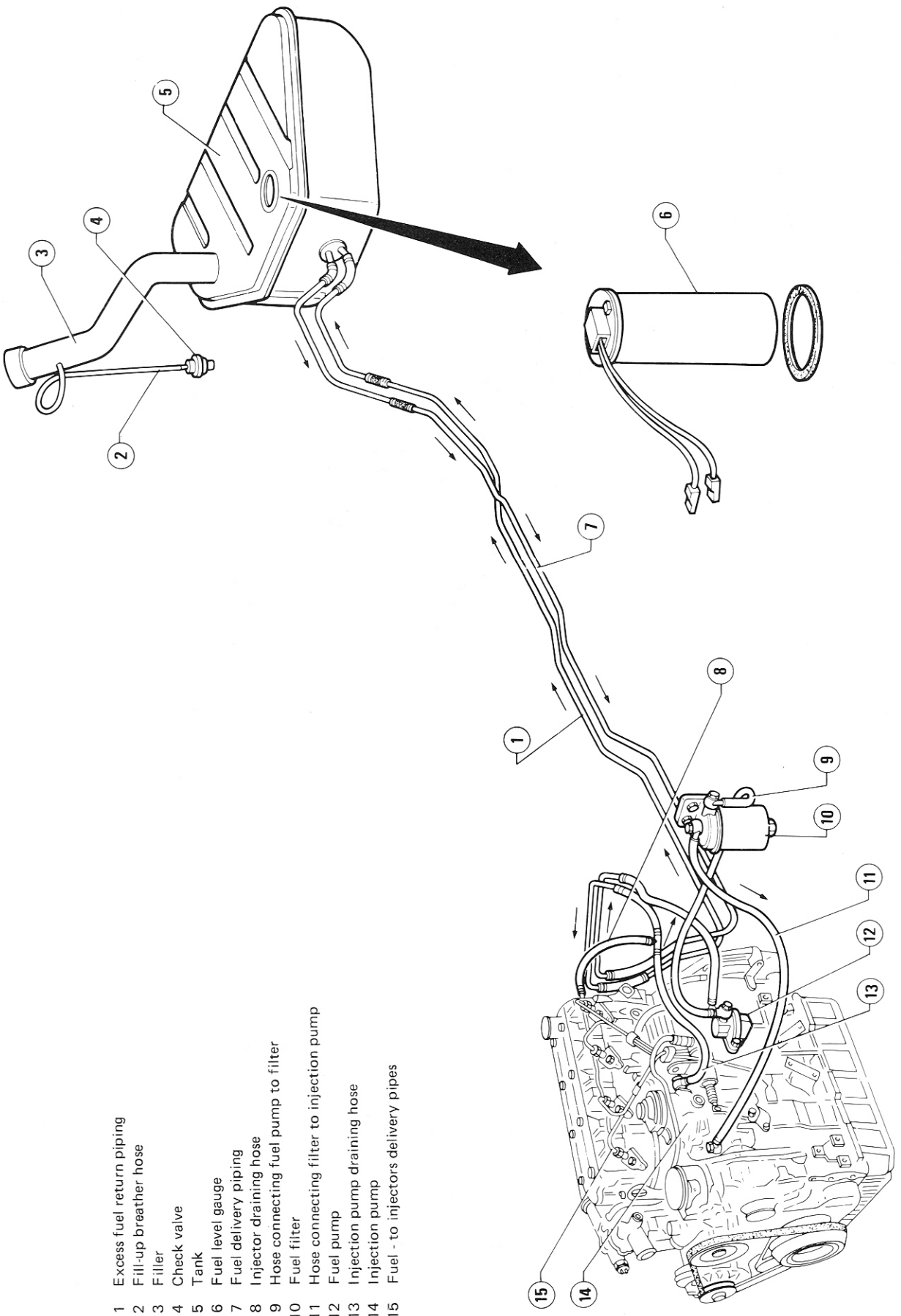
1 Sleeve between intercooler and intake manifold
2 Screw securing intercooler to body
3 Intercooler support bracket
4 Intercooler
5 Rubber pads
6 Sleeve between turbocharger and intercooler

6. Carry out installation by reversing the order of removal; then restore liquid in the cooling system.

TIGHTNESS TEST

1. Remove intercooler from vehicle (refer to: Removal and Installation).
2. Plug the intercooler outlet union, and fit a suitable union for introducing compressed air, on the inlet union.
3. Immerge intercooler into a container filled with water, blow compressed air until reaching **120 kPa (1.2 bar; 1.22 kg/cm^2; 17.35 p.s.i.)** pressure and identify any leaks.
4. If leaks are present, replace intercooler following the procedure described in "Removal and Installation".

FUEL SUPPLY SYSTEM



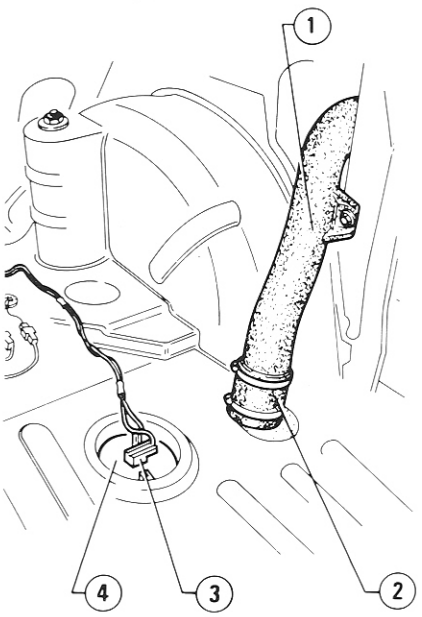
1 Excess fuel return piping
2 Fill-up breather hose
3 Filler
4 Check valve
5 Tank
6 Fuel level gauge
7 Fuel delivery piping
8 Injector draining hose
9 Hose connecting fuel pump to filter
10 Fuel filter
11 Hose connecting filter to injection pump
12 Fuel pump
13 Injection pump draining hose
14 Injection pump
15 Fuel - to injectors delivery pipes

WARNING:
Before replacing any fuel system components, strictly follow the indications below:
a. Ensure that the workshop is correctly equipped to enable operations to be performed safety.
b. Disconnect the battery ground cable.
c. Collect the fuel drained from tank into a suitable container fitted with a safety cover.

FUEL TANK

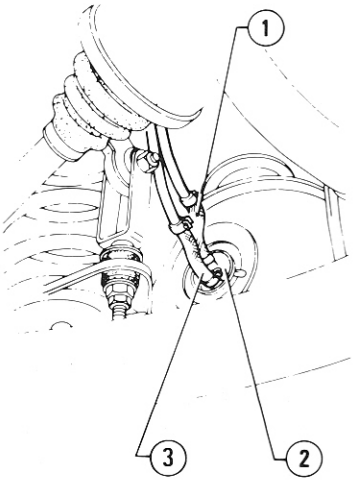
REMOVAL

1. Set vehicle on a column lift, remove filler cap, and suck fuel from tank, by means of a suitable pump.
2. Remove the luggage compartment lower trim, move the right-hand side trim, and remove cover of fuel level gauge.
3. Detach connector (3).
4. Loosen the clamp and disconnect sleeve (2) from tank without damaging the rubber gasket underneath.



1 Filler
2 Sleeve connecting filler to tank
3 Connector for fuel level indicator
4 Fuel level gauge

5. Raise vehicle on a lift and disconnect hoses (1) and (3) from flange (2) on tank.



1 Fuel return hose
2 Flange for hoses connection to tank
3 Fuel delivery hose

6. Support tank with a column lift, unscrew the three screws securing tank to body, and remove tank.
7. If required, disassemble tank.

CHECKS AND INSPECTIONS

Check for cracks or deformations of tank; replace if required.

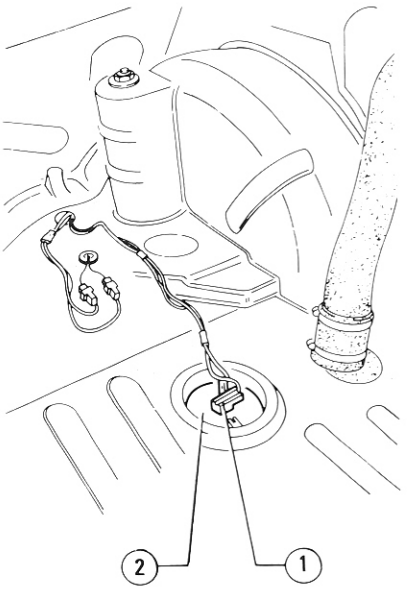
INSTALLATION

Install tank on vehicle by reversing the order of removal; verify that the rubber gasket between tank and luggage compartment floor, in correspondance with filler, is correctly positioned.

FUEL LEVEL GAUGE

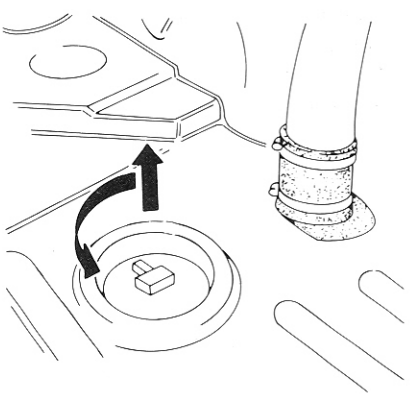
REPLACEMENT

1. Remove the luggage compartment floor trim.
2. Remove the cover of fuel level gauge (2), and detach connector (1).



1 Connector for fuel level indicator
2 Fuel level gauge

3. By means of a suitable tool, rotate the fuel level gauge counterclockwise, then withdraw it from tank, together with the related gasket.



4. Replace gasket before installing the fuel level gauge on tank.

FUEL SUPPLY PIPING

REMOVAL

CAUTION:
Disconnect the fuel system piping only when strictly required.

1. Set vehicle on a lift.
2. Remove filler cap and suck fuel from the tank by means of a suitable pump.
3. Loosen the clamps securing the ends of the hoses to be removed.

CAUTION:
Plug both hoses and pipes so as to prevent dust or any foreign matter from entering during the disassembly operations.

4. To remove the piping on the floor inside the passenger compartment, remove the floor trim on the right-hand side.

CHECKS AND INSPECTIONS

1. Check for porosity and deterioration of hoses; replace the damaged hoses.
2. Check for oxidation, dents or clogging of pipes.

INSTALLATION

Carefully install piping by reversing the order of removal, complying with the following indication.

CAUTION:
a. **Carefully fit the clamps on system joints. Do not tighten clamps excessively so as to prevent damaging piping.**
b. **Do not bend or twist pipes when reconnecting them on vehicle.**
c. **The piping inside the vehicle must be inserted into the related holes up to the red reference marked on each hose.**
d. **Start the engine and check for leaks from joints.**

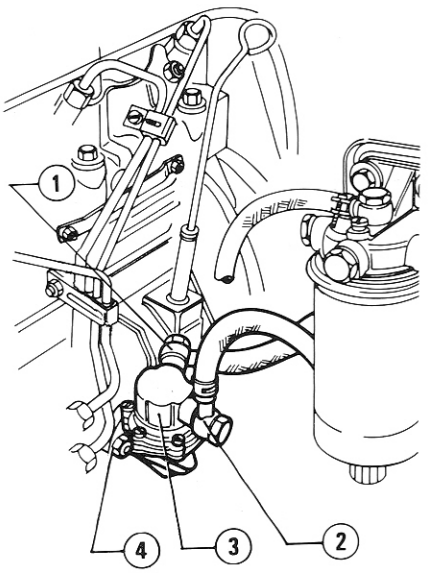
FUEL PUMP

REPLACEMENT

1. Open the bonnet and support it with the support rod provided.
2. Disconnect the battery terminals, detach the related securing bracket; then remove battery.
3. Detach fuel inlet/outlet hoses unions (1) and (2) from fuel pump (3).

Keep hoses upwards so as to prevent fuel from escaping.

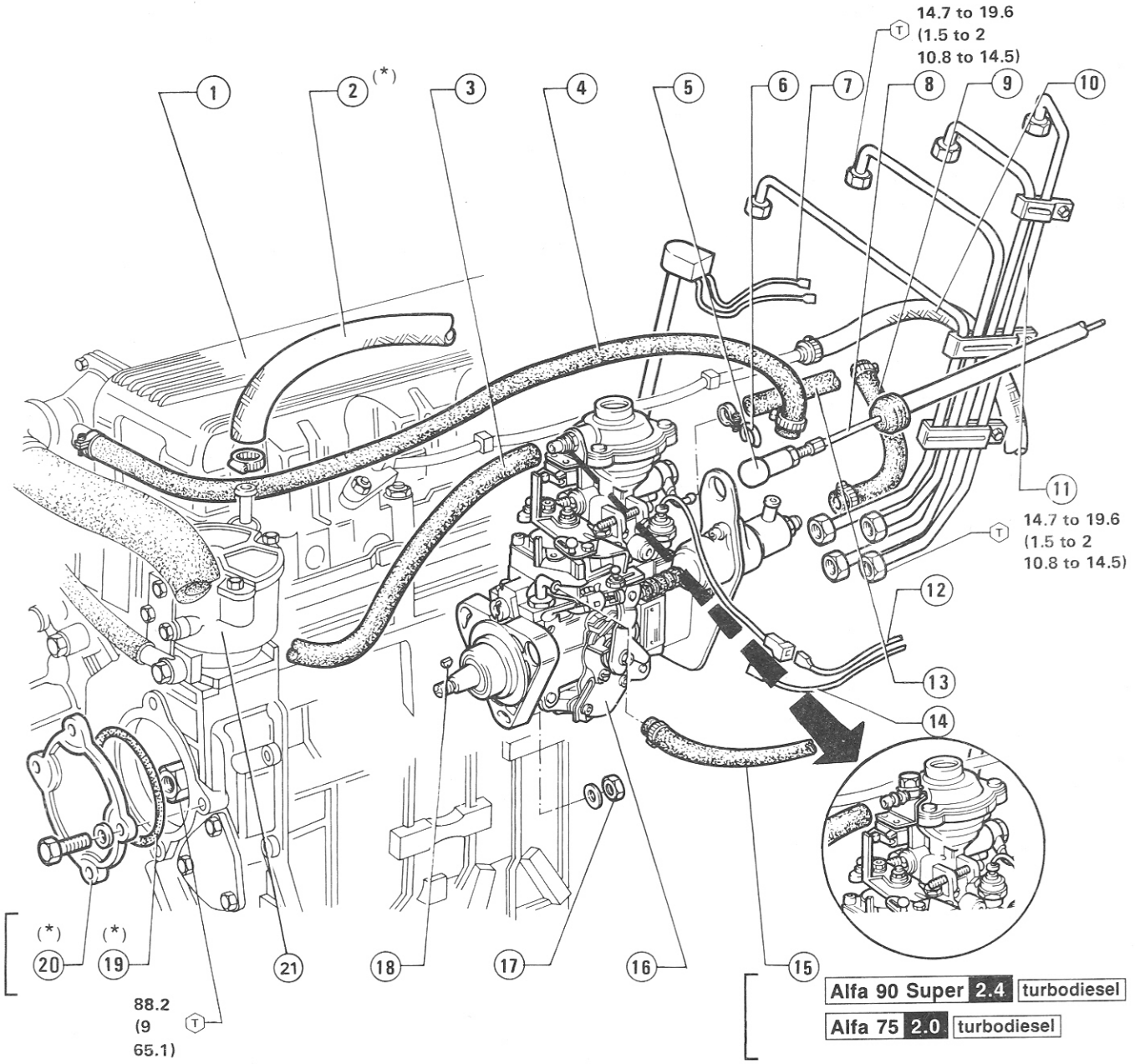
4. Unscrew nuts (4) securing fuel pump to engine block, then remove pump with the related gasket.



1 Union for fuel inlet hose
2 Union for fuel outlet hose
3 Fuel pump
4 Nut securing fuel pump to engine block

5. Install fuel pump by reversing the order of removal, taking care to interpose new gaskets between fuel pump and engine block and on fuel hoses unions. Then, carry out fuel system bleeding.

INJECTION PUMP



1 Tappets cover
2 Servobrake vacuum intake cover (*)
3 Injection pump pneumatic control hose
4 Hose for liquid delivery to automatic advance device
5 Ball joint
6 Clip
7 Cable for min engine oil level warning lamp for ALFA ROMEO Control
8 Accelerator control cable
9 Hose for liquid outlet from the automatic advance device
10 Injectors draining hose
11 Fuel - to injectors delivery pipe
12 Engine stop electromagnet control cable
13 Pump draining hose
14 Cable for r.p.m. - activated microswitch
15 Fuel - to pump inlet hose
16 Injection pump
17 Nut securing pump to engine block
18 Tongue
19 O-ring (*)
20 Cover (*)
21 Vacuum pump (*)

(*) Only for Alfa 90 2.4 turbodiesel
Alfa 75 2.0 turbodiesel

REMOVAL

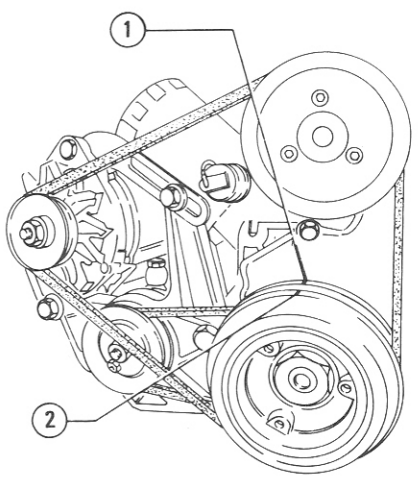
1. Open the bonnet and support it with the support rod provided. Remove the bolts securing hinges, then open the bonnet completely.

WARNING:
Proceed with care when working on a hot engine to avoid being burned.

2. Detach both negative and positive terminals of battery; release the securing bracket from the two side tie rods, then remove battery together with container underneath.
3. Detach lower sleeve from radiator and drain coolant.

Recover coolant into a suitable container.

4. Unscrew the nuts securing tappets cover and move it on turbocharger side.
5. Engage the 5th speed and move vehicle forward so as to rotate crankshaft in the running direction (crankshaft clockwise rotation, seen from the front side) until notch (2) on crankshaft pulley, is aligned with the fixed index (1) on front cover (1st cylinder in the compression stroke; valves closed).



1 Index
2 T.D.C notch

For the following steps, refer to the initial exploded view.

6. Disconnect the following cables from the indicated part.
- Cable (7), from oil dipstick.
- Cable (12), from movable connector.
- Cable (14), from the r.p.m. - activated microswitch on injection pump.

7. Release and remove clip (6) securing accelerator cable ball joint (5). Detach ball joint and remove it from support bracket together with cable fairlead.
8. Loosen support bracket of power steering oil tank; withdraw tank from bracket and move it sideways.
9. Disconnect the following hoses from the indicated part.

- *Only for*
  Alfa 90 2.4 turbodiesel and
  Alfa 75 2.0 turbodiesel
- Hoses (4) and (9) from the automatic advance device.
- Hoses (13) and (15), from injection pump.

CAUTION:
Keep the supply and draining hoses upwards to prevent fuel escaping.

- Hose (3),from regulator on injection pump.

10. Unscrew the unions on injectors and injection pump, them remove the fuel - to injectors delivery pipes (11).

For the following steps, refer to the figure immediately after the text.

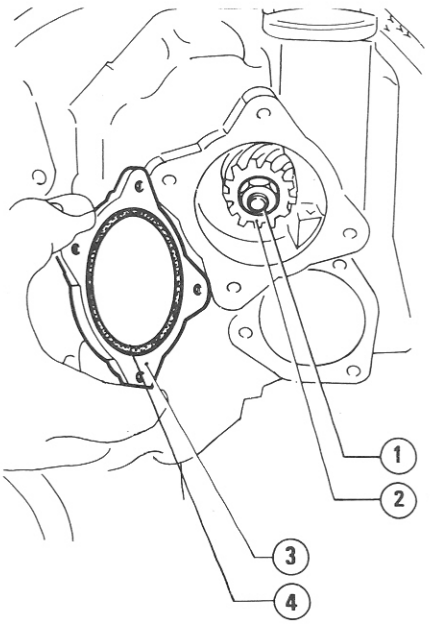
11. *Only for*
Alfa 90 2.4 turbodiesel and
Alfa 75 2.0 turbodiesel
Remove the injection pump proceeding as follows.

a. Verify that crankshaft is correctly positioned (refer to step 5.).

b. Unscrew the four securing screws of injection pump gear (2), cover (3), remove cover with O-ring (4).

c. Loosen and remove nut (1) securing gear to injection pump control shaft.

Engage the 5th speed and parking brake so as to prevent crankshaft rotating. At the end of operation, disengage the speed.



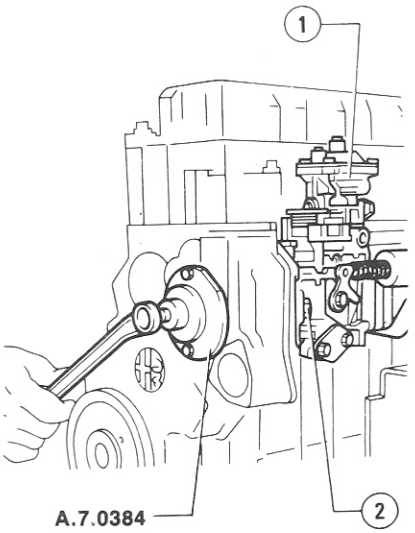
1 Nut
2 Pump gear
3 Cover
4 O-ring

d. Tighten body of tool **A.7.0384** into the hole of injection pump gear and fit the related flange on tool body, securing it, into body slot, by means of the dowel, and to engine front cover by means of two screws, respectively.

CAUTION:
For the whole period in which tool A.7.0384 is applied, the crankshaft must not be rotated.

e. Unscrew and remove the three nuts (2) securing injection pump to engine block.
f. Withdraw injection pump, screwing tool **A.7.0384** screw.

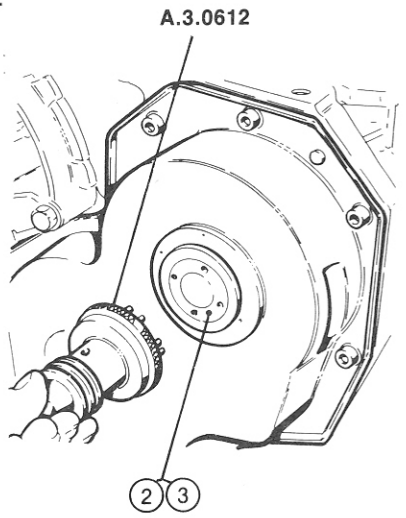
CAUTION:
Tool A.7.0384 shall be left mounted on engine front cover until injection pump is reassembled, in order to prevent control gear from moving accidentally.



1. Injection pump
2. Nut

11. *Only for vehicles*
Alfa 90 Super 2.4 turbodiesel

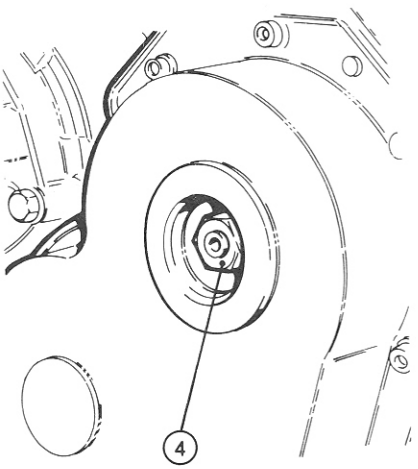
Remove the injection pump proceeding as follows:
a. Make sure the crankshaft is correctly positioned (see step 5. above).
b. Using tool **A.3.0612** remove plug (1) with O-ring (2) from cover (3).



1. Plug
2. O-ring
3. Front cover

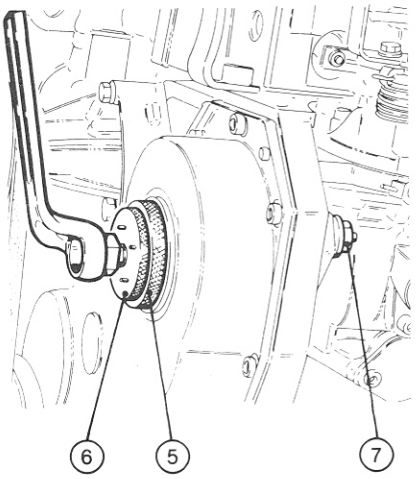
c. Remove nut (4) securing the gear on the injection pump drive shaft.

NOTE:
Engage a speed and the parking brake in order to prevent the crankshaft from rotating.
Upon completion of the operation disengage the speed.



4. Securing nut, injection pump gear

d. Screw flange (5) of tool **A.3.0612** on the cover and lock the former manually. Then screw body (6) of tool **A.3.0612** into the injection pump gear hole.
e. Remove three nuts (7) securing the injection pump to the engine block and remvoe the pump screwing the screw of tool **A.3.0612**.



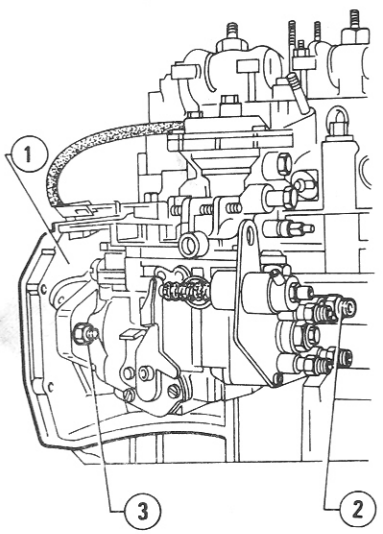
5. Flange
6. Tool body
7. Injection pump securing nut

CAUTION:
In order to prevent the drive gear from moving accidentally, tool A.3.0612 shall be left mounted on the front cover of the engine till the injection pump is reassembled.

INSTALLATION

1. Install injection pump proceeding as follows.
a. Direct the tongue of injection pump shaft towards union (2) of 1st cylinder delivery hose (upper union, engine side).
b. Insert the injection pump after having applied sealing compound LOWAC PERFECT SEAL on flange (1) of engine block; injection pump must be positioned centering the slots with respect to studs; fit the three nuts (3) of pump and tighten them.

When inserting injection pump, partially unscrew the screw of tool secured to engine cover.



1. Flange
2. Union for 1st cylinder delivery hose
3. Nut

c. Remove tool from engine cover.

Make sure that the tongue of injection pump shaft is correctly positioned in the gear seat.

d. Insert and tighten the nut securing injection pump control gear to the prescribed torque.

(T) : **Tightening torque**
Nut securing injection pump control gear (in engine oil)
88.2 N·m
(9 kg·m;
65.1 ft·lb)

Engage the 5th speed and parking brake, so as to prevent crankshaft rotating. At the end of operation, disengage the speed.

2. Carry out the injection pump timing (refer to: Timing of Injection Pump).

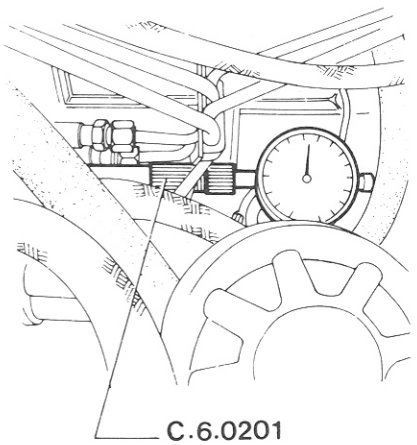
3. Install the cover of injection pump gear, providing for a new O-ring.
4. Install tappets cover securing it with the related nuts.
5. Reconnect the fuel - to injector delivery pipes, to pump and injectors; then tighten unions to the prescribed torque.

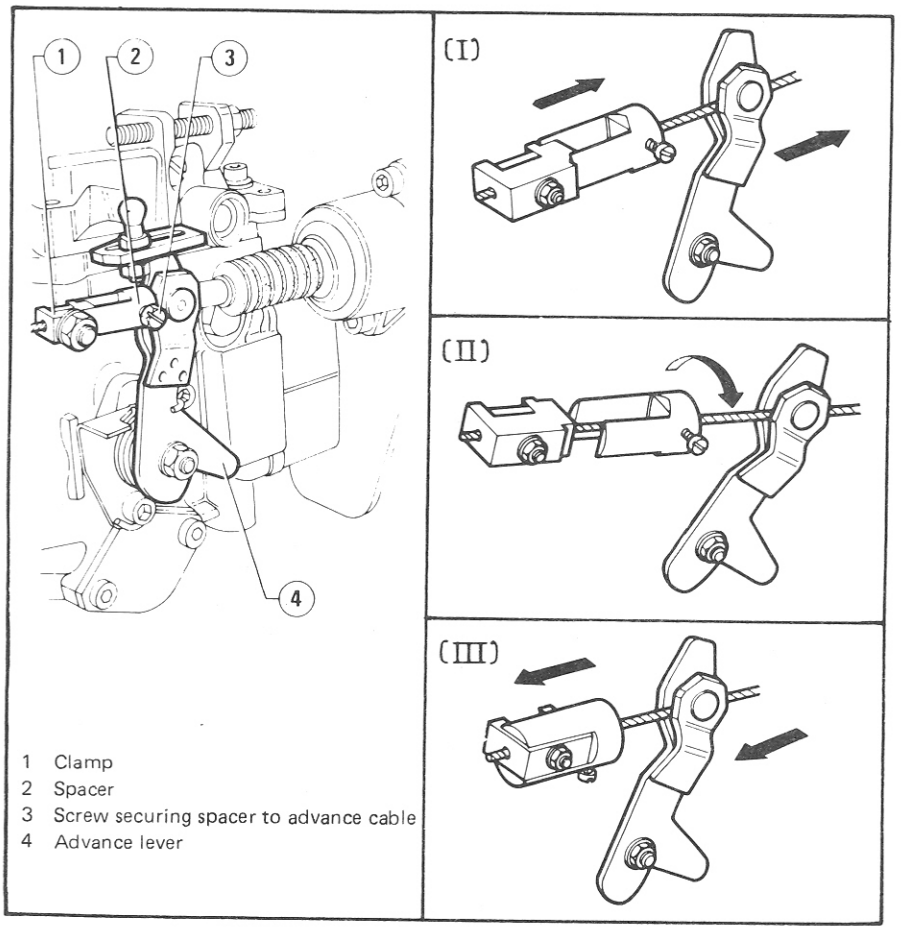
(T) : **Tightening torque**
Unions for fuel - to injectors delivery pipes
14.7 to 19.6 N·m
(1.5 to 2 kg·m;
10.8 to 14.5 ft·lb)

6. Complete installation by reversing the order of removal and complying with the following indications.
a. Fill the engine cooling system (refer to: Group 07 - Radiator - Cooling System Refill).
b. Carry out bleeding of fuel system (refer to: Alfa 90 2.4 turbodiesel "WORKSHOP MANUAL - Group 00 - Engine Maintenance").
c. Carry out the following adjustments in sequence, referring to paragraph SETTINGS AND ADJUSTMENTS.
- Adjustment of engine r.p.m.
- Adjustment of r.p.m. - activated switch control lever
- Adjustment of accelerator cable backlash
- Fast idle r.p.m. at start - up

TIMING OF INJECTION PUMP

Should only the verification of injection pump timing be required, the use is possible of tool C.6.0201 in the place of tool A.7.0333, thus avoiding to disconnect the delivery unions to injectors.





1 Clamp
2 Spacer
3 Screw securing spacer to advance cable
4 Advance lever

1. On cold engine, operate as follows in order to make sure that the automatic advance lever is completely moved towards engine front side (advance disactivated).

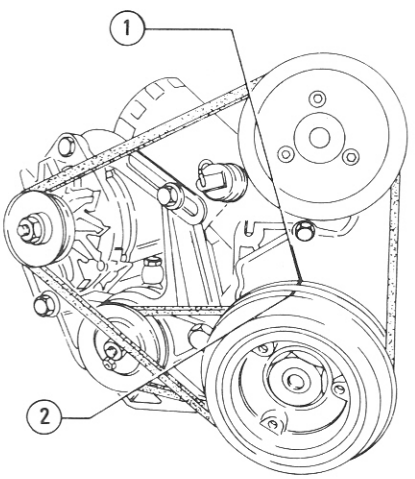
a. Loosen screw (3).

b. Move lever (4) towards engine rear side, following the arrow shown in the figure (I), and release spacer (2) from terminal (1).

c. Always keeping lever (4) moved, and operating as shown in the figure III and II, rotate spacer (2) by **90°**, then insert it into clamp (1).

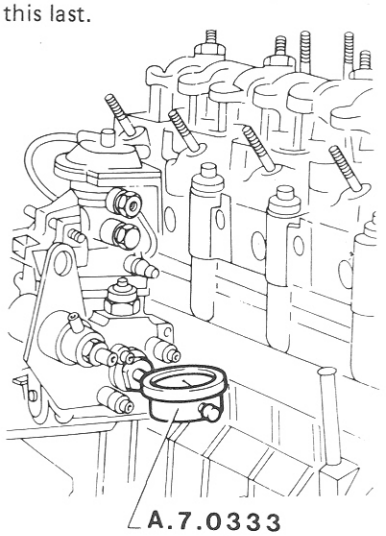
d. Release lever (4), which will thus be positioned in the "fully forward" position, thus excluding the injection pump advance.

2. Verify that notch (2) of crankshaft pulley is aligned with fixed index (1) on engine front cover.



1 Index
2 T.D.C. notch

3. Remove the injection pump rear screw located in the centre of injector delivery unions; fit tool **A.7.0333** fitted with dial gauge and preload this last.



4. Rotate crankshaft in the opposite direction with respect to the functioning direction (crankshaft counterclockwise rotation, seen from front side) until the dial gauge index stops, i.e., it stops following crankshaft movement **25°** to **30°** before

T.D.C. (pumping elements in the rest position). Reset dial gauge in this position.

5. Slowly rotate crankshaft in the running direction until obtaining the conditions prescribed in step 2.

6. Verify that, in this position, the dial gauge indicates **0.78 to 0.80 mm (0.0307 to 0.0315 in)** for engines **VM 81 A (2400); 0.97 to 0.99 mm (0.0382 to 0.0390 in)** for engines **VM 80 A (2000).** This value, measured at the T.D.C., corresponds to an advance angle of 4° for engines **VM 81 A (2400)** and 6° for engines **VM 80 A (2000).** If a different indication is read on dial gauge, loosen the nuts securing injection pump.

7. Carry out the timing check verifying that the previous operations have been correctly executed, i.e.:

- bring crankshaft at **30°** approx., before T.D.C.; verify that, when in this position, dial gauge is zeroed.
- Slowly rotate crankshaft in the running direction until the T.D.C. notch, on engine pulley, is aligned with the fixed index on engine cover; in this position, the dial gauge indicates a movement within **0.78 to 0.80 mm (0.0307 to 0.0315 in)** for engines **VM 81 A (2400); 0.97 to 0.99 mm (0.0382 to 0.0390 in)** for engines **VM 80 A (2000).**

8. Should slight adjustment of both advance and delay be required, loosen the securing nuts of pump (item (17) exploded view on page 04-11), then rotate it clockwise (looking at the engine from the front) to advance, and counterclockwise to delay, respectively; then tighten nuts.

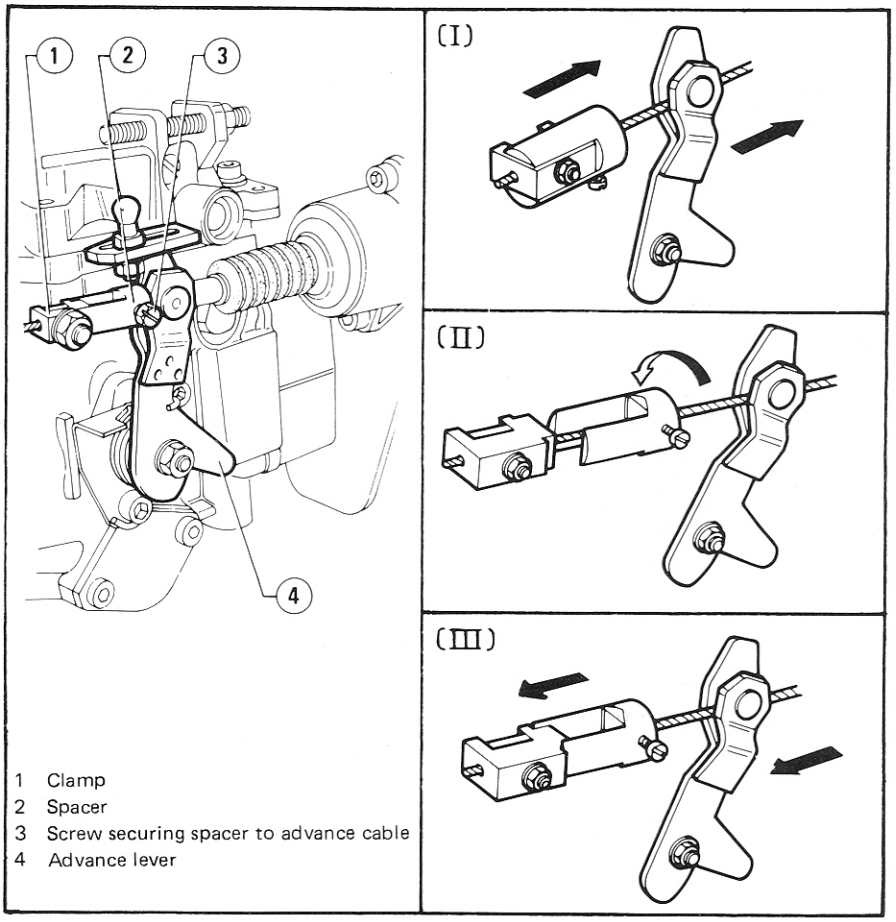
9. Remove tool **A.7.0333** with dial gauge, then refit the injection pump rear screw with the related copper gasket.

10. Restore correct position of the advance lever operating as follows.

a. Move lever (4) towards engine rear side and keep it in this position.

b. Separate spacer (2) from clamp (1), then rotate spacer (2) by **90°** following the arrows shown in the figure, so as to set it to the initial position.

c. Release advance lever (4) and tighten screw (3).



1 Clamp
2 Spacer
3 Screw securing spacer to advance cable
4 Advance lever

R.P.M. -ACTIVATED MICROSWITCH

REPLACEMENT

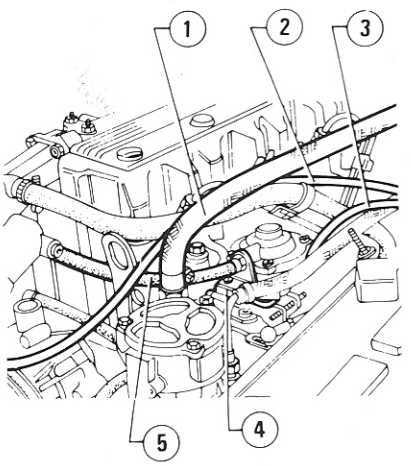
a. Disconnect the battery negative terminal.

b. Disconnect the vacuum intake hose (1) from vacuum pump.

c. Disconnect cable (2) from the oil dipstick, then release cable from securing clamps.

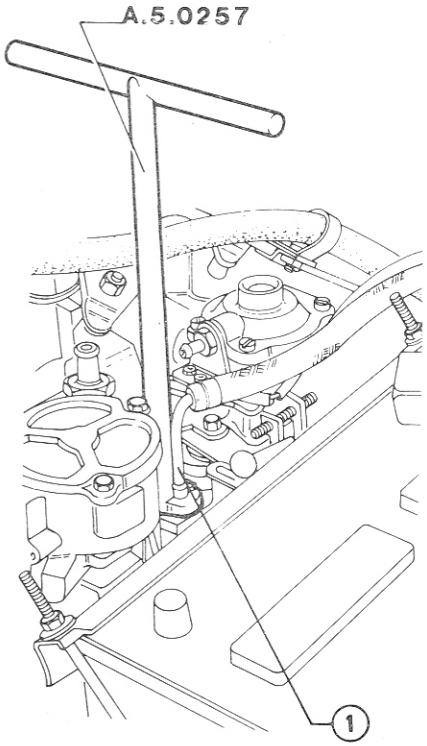
d. Disconnect hose (5) from the pneumatic control device on injection pump.

e. Disconnect cable (3) from microswitch (4).



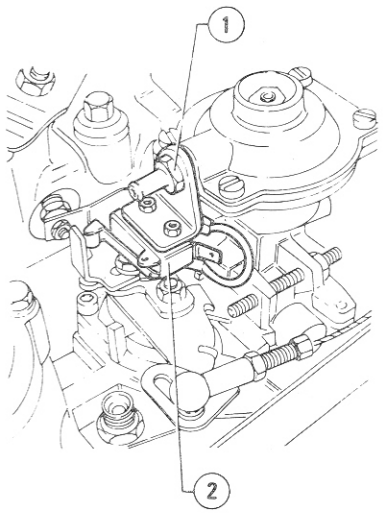
1 Servobrake vacuum intake hose
2 Cable for min oil level sender
3 Cable for r.p.m. - activated microswitch
4 R.p.m. - activated microswitch
5 Hose for injection pump pneumatic device control

f. By means of tool **A.5.0257**, unscrew union of hose (1) and disconnect it from the injection pump.



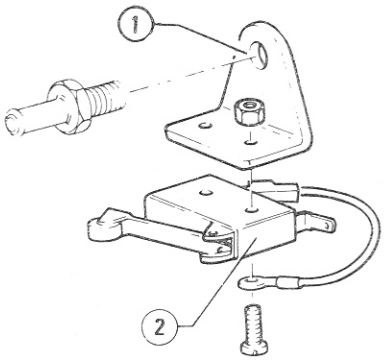
1 Fuel - to injection pump inlet hose

g. Unscrew union (1), and remove microswitch (2) complete with bracket.



1 Union
2 Microswitch

h. Operating at bench, unscrew the two bolts securing microswitch to bracket, then recover bracket.



1 Bracket securing microswitch
2 Microswitch

i. Carry out the installation by reversing the order of removal, complying with the indications that follow.

- When installing the microswitch on bracket, remember that one of the bolts secures the microswitch ground cable.
- Lay a coat of sealing compound on the unions securing microswitch bracket.
- Before completing installation, adjust the control lever of the r.p.m. activated microswitch (refer to: Settings and Adjustments - Adjustment of the Control Lever for r.p.m. Activated Microswitch).

SETTINGS AND ADJUSTMENTS

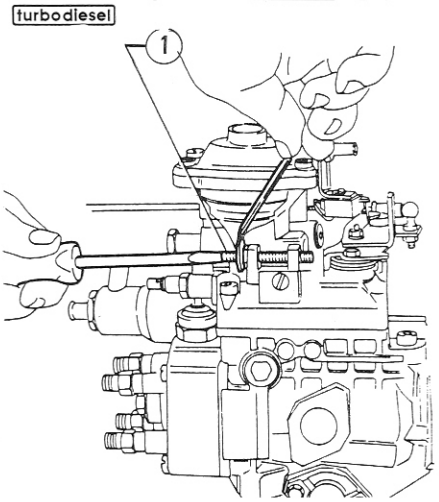
CHECK AND ADJUSTMENT OF IDLE R.P.M.

Adjust the idle r.p.m., with engine at normal running temperature, speed gear to neutral, and all auxiliary devices excluded, by operating as follows.

Release locknut and operate adjusting screw (1) until obtaining the prescribed value of:

800 to 900 r.p.m. for **Alfa 90** **2.4** turbodiesel

800 to 850 r.p.m. for **Alfa 75** **2.0** turbodiesel



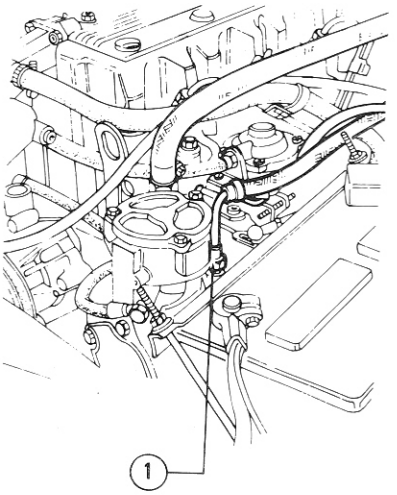
1 Adjusting screw

ADJUSTMENT OF CONTROL LEVER FOR R.P.M. - ACTIVATED MICROSWITCH

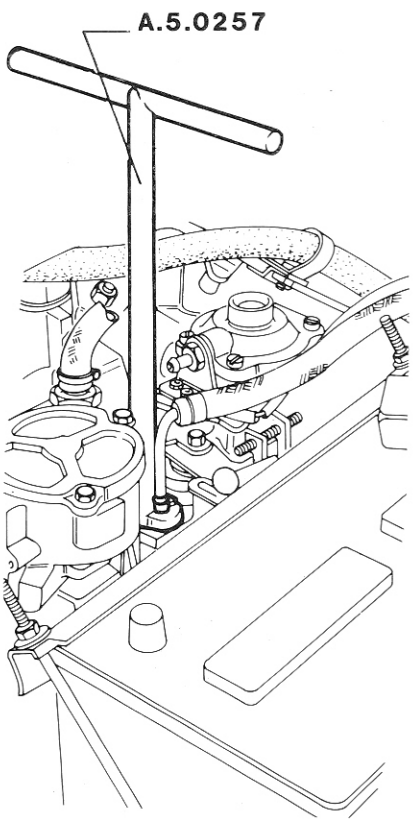
The adjustment of this control lever must be carried out after having adjusted the idle r.p.m. at the prescribed value. (Refer to: Check and Adjustment of Idle r.p.m.).

WARNING:
This adjustment must be carried out without disconnecting the battery terminals; the utmost care is then required when executing this operation.

1. By means of tool **A.5.0257**, unscrew union (1) and detach it from the injection pump.

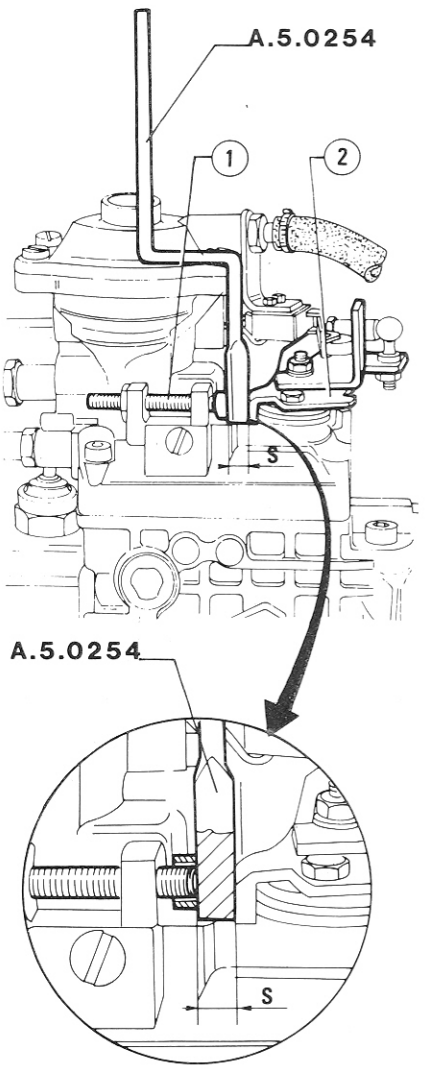


1 Adjusting screw



2. Move lever (2) and place feeler gauge **A.5.0254** between lever itself and screw (1) so that the "s" distance prescribed can be obtained.

Distance between accelerator control lever and idle r.p.m. adjusting screw
S = 5.5 mm (0.2165 in)

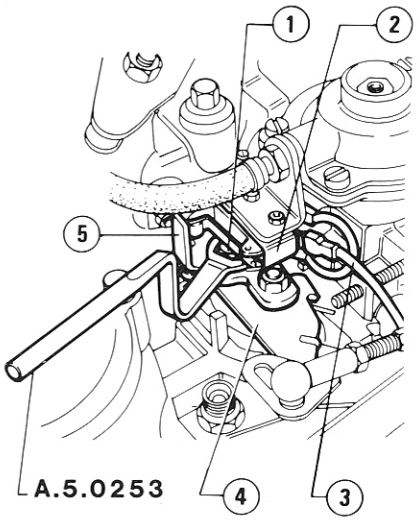


1 Idle r.p.m. adjusting screw
2 Accelerator control lever

3. Detach connector (3) from microswitch (2).
4. Connect a test lamp between terminal of microswitch (2) and the battery positive terminal.
5. By means of wrench **A.5.0253**, loosen screw (1). Move near or away the microswitch (2) control bracket (5) until activating or deactivating microswitch itself. When executing this operation, the warning lamp switches on or off.

6. Lock screw (1), as soon as switching takes place, by means of wrench **A.5.0253.** Then, verify the correct operation of levers.

The correct adjustment of the r.p.m. - activated microswitch control guarantees the deactivation of the pre-heating glow plugs when engine exceeds 1300 to 1900 r.p.m. before timer by-passes the glow plugs supply.



1 Screw securing bracket to accelerator control lever
2 R.p.m. - activated microswitch
3 Connector
4 Accelerator control lever
5 Microswitch control bracket

7. Remove tools and attach connector to microswitch and fuel hose union to injection pump by reversing the order of removal.

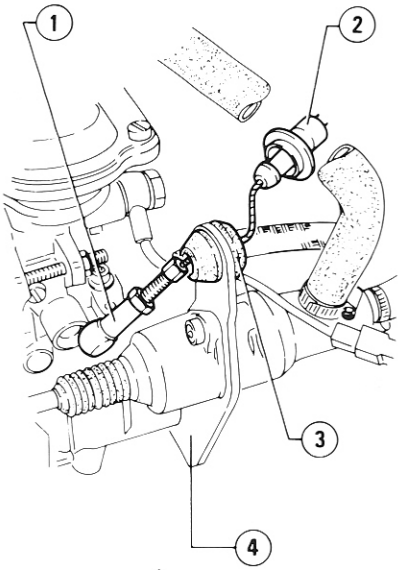
ADJUSTMENT OF ACCELERATOR CABLE BACKLASH

Refer to: WORKSHOP MANUAL Alfa 90 - Group 00 - Engine Maintenance - 2.4 turbodiesel

ADJUSTMENT OF FAST IDLE R.P.M. ON START-UP

The adjustment of the fast idle r.p.m. on start-up, must be carried out after having adjusted the idle r.p.m. and the accelerator cable backlash.

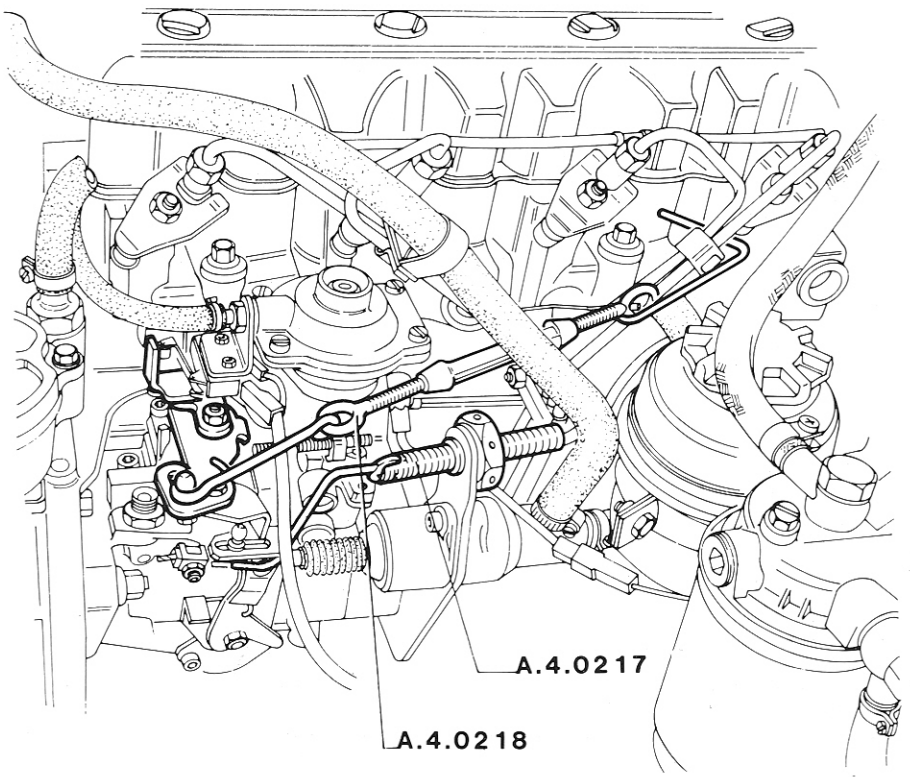
1. Disconnect ball joint (1) of the accelerator control cable, and remove sheath (2) with fair lead (3) of bracket (4) placed on the automatic advance device.



1 Ball joint
2 Sheath
3 Fair lead
4 Bracket

2. Position tie rod **A.4.0218** on the accelerator control lever, and tool **A.4.0217** on the accelerator bracket, securing tool to the advance control lever.

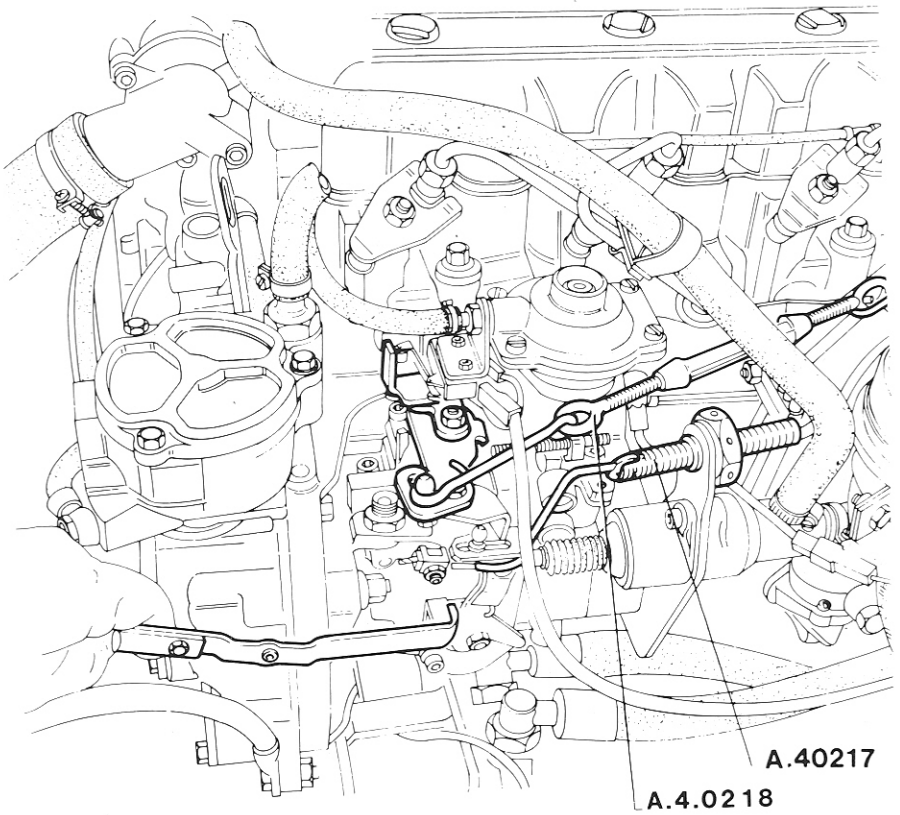
CAUTION:
Tool A.4.0217 is required to prevent the load of the advance lever spring from altering the preference lever position.

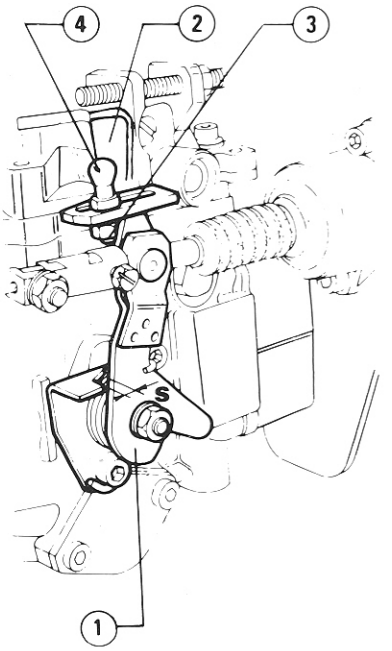


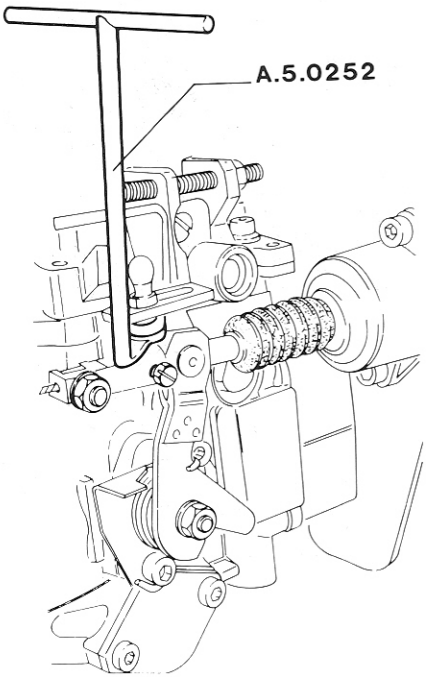
3. Start the engine and operate on lever **A.4.0218** until coolant temperature exceeds **40°C (104°F)**.

4. By means of tie rod **A.4.0217**, move lever (1), then interpose a shim between advance control lever and the related end-of-travel, so that dimension "S" is obtained.

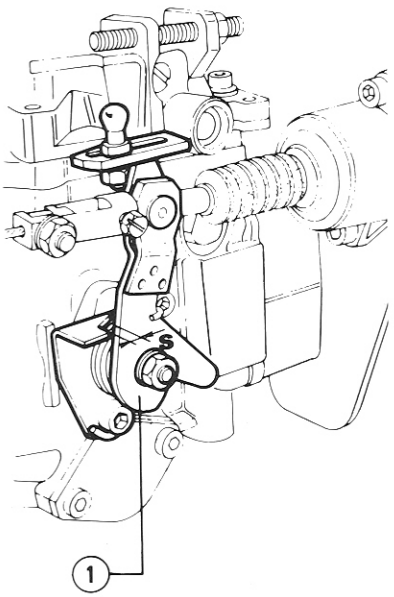
Distance between advance control lever and end-of-travel (coolant temperature exceeding 40°C (104°F)
S = 3 mm (0.1181 in)







1 Advance control lever
2 Accelerator lever tab
3 Nut securing advance control lever pin
4 Accelerator control lever pin



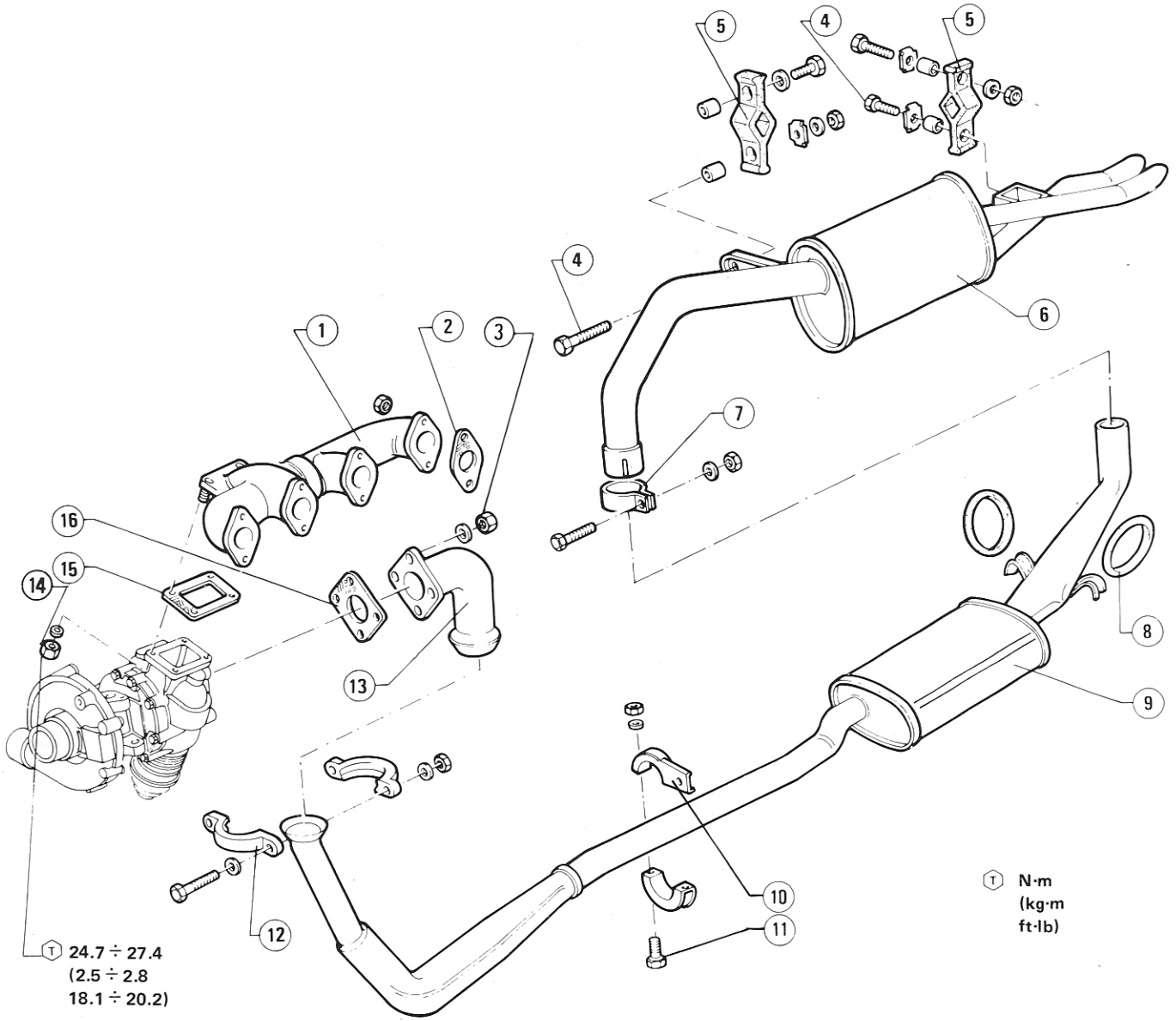
1 Advance control lever

5. By means of tie rod **A.4.0218** operate on the accelerator control lever bringing the engine at **1000 to 1100 r.p.m.** with ancillary equipment deactivated.

6. By means of wrench **A.5.0252**, loosen nut (3) and move pin (4) until resting it on tab (2), located on the accelerator lever.

7. Remove tools and re-connect the accelerator control cable by reversing the order of removal, taking care to reconnect the ball joint and the fair lead on the bracket placed on the automatic advance device.

EXHAUST SYSTEM



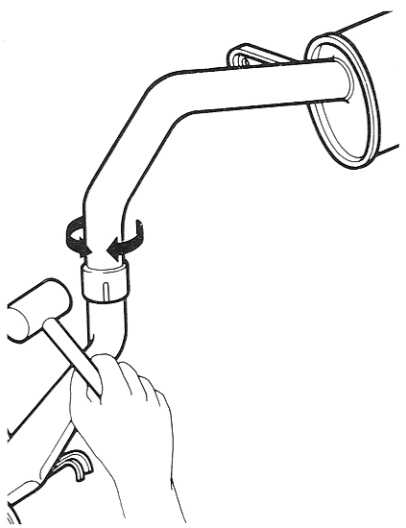
1 Exhaust manifold
2 Gasket
3 Nut securing union to turbocharger
4 Bolt
5 Rubber support
6 Exhaust pipe - tail pipe
7 Clamp
8 Support retaining ring
9 Exhaust pipe - front section
10 Bracket
11 Bolt
12 Collar
13 Exhaust gas union
14 Nut securing turbocharger to manifold
15 Gasket
16 Gasket

a. **The procedures described, permit each component of the system to be removed, when required.**
b. **The removal procedure can be modified in relation to the purpose of the operation.**
c. **When removing the complete exhaust system, the aid of another operator could be required.**

MANIFOLDS AND SILENCERS

REMOVAL

With reference to the previous figure, carry out the removal operating as follows.
1. Raise vehicle on a lift.
2. Disconnect tail pipe (6) operating as follows.
a. Loosen clamp (7).
b. Unscrew and remove bolts (4) securing tail pipe to rubber supports (5).
c. Tap slightly and repeatedly, by means of a plastic hammer along the piping circumference, in correspondance with the connection between the two sections, then rotate tail pipe alternatively in both directions, with respect to front section so as to make separation easier.



3. Detach front section (9) of exhaust system, operating as follows.
a. Lift bonnet, disconnect hinges and open it completely.

WARNING:
For maximum safety, the bonnet should be kept in position using the method the operator considers most suitable.

b. Disconnect battery.
c. Remove heath shield on the exhaust manifold and the starter cover.
d. Loosen and remove collar (12).
e. Support front section (9), unscrew bolts (11) and detach bracket (10).
f. Release front section (9) from retaining rings (8), and remove it.
4. Disconnect exhaust gas union (13), operating as follows.
a. Unscrew nuts (3) securing union (13) to turbocharger. To make the removal easier, it is advisable to remove the complete air filter (refer to: Supercharging System - Air Filter - Removal).
b. Withdraw union (13) from the studs, together with gasket (16).
5. Disconnect the exhaust gas manifold, operating as follows.
a. Remove turbocharger (refer to: Turbocharger - Removal).
b. Unscrew the nuts securing manifold (1) to heads. Two of these nuts secure the engine lifting rear bracket.
c. Remove manifold (1) together with gaskets (2).

CHECKS AND INSPECTIONS

1. Check for damages, cracks or signs of corrosion in the silencers and exhaust piping. Replace if required.
2. Check rings and rubber supports; replace them in the event of cracks, porosity or if worn.

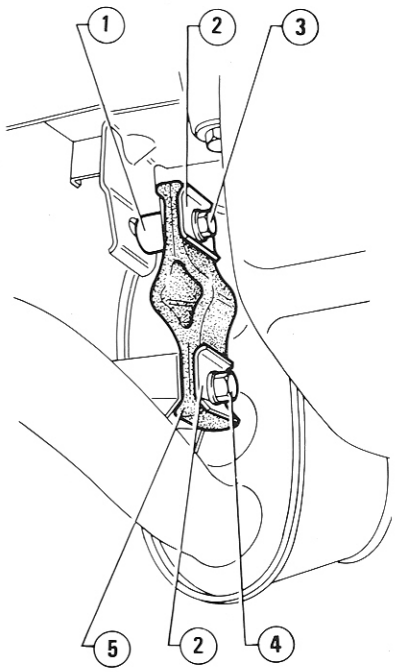
INSTALLATION

Install each component by reversing the order of removal, complying with the following indications:
a. Fit **new** gaskets on exhaust manifold and union (if previously disconnected).
b. At the end of installation, verify that rubber support rings can oscillate freely, that they are not taut, and that brackets are correctly secured.
c. On engine running, check for gas leaks from piping connections and for unusual noise from the system.

RUBBER SUPPORTS

REPLACEMENT

1. Raise vehicle on a lift.
2. Unscrew lower bolt (4), and recover plate (2) and the support inner spacer.
3. Unscrew bolt (3), and remove support (5) with related plate (2), outer spacer (1) and the support inner spacer.



1 Outer spacer
2 Plate
3 Bolt securing support to body
4 Bolt securing exhaust pipe to support
5 Rubber support

4. As regards the ring support, proceed by simply releasing the support from clamps.

5. Carry out the installation by reversing the order of removal; once installation has been carried out, verify that supports can oscillate freely and are not taut.

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

TURBOSUPERCHARGER

Data	Engines		
	2000	2400 (Alfa 90)	2400 (Alfa 90 Super)
	VM 80A	VM 81A	
Alfa Romeo part No.	161.04.08.090.00	162.06.08.090.01	161.04.08.090.00
Manufacturer	K K K		
Type	K 16 - 2267 G GA/4.51	K 24 - 2464 G A 3.54	K 16 - 2267 G GA/4.51

FUEL SUPPLY PUMP

Data	Engines	
	2000	2400
	VM 80 A	VM 81 A
Alfa Romeo part No.	116.76.04.020.00	
Manufacturer	CORONA	
Type	1920	

FUEL TANK

Unit: l (Imp. gall.)

Data	Engines	
	2000	2400
	VM 80 A	VM 81 A
Overall capacity	49 (10.78)	
Reserve	8 (1.76)	

INJECTION

Data		Engines	
		2000	2400
		VM 80 A	VM 81 A
Injection pump	Alfa Romeo part No.	161.04.04.096.00	162.06.04.096.00
	Manufacturer	BOSCH	
	Type	VE 4/10 F 2150 L 202	VE 4/10 F 2100 L 168-1
Injectors	Alfa Romeo part No.	116.76.04.040.00	
	Manufacturer	BOSCH	
	Type	KBE 58 S 4/4	
Timing (advance) degrees B.T.D.C.	Fixed advance (1)	6°	4°
	Max. advance	28°	
Injection order (2)		1 - 3 - 4 - 2	

(1) For timing check, position piston No. 1 to TDC of compression stroke-end and, using a suitable dial gauge, ensure that injection pump plunger has covered a stroke of:
0.97 to 0.99 mm (0.0382 to 0.0390 in) for engine 2000
0.78 to 0.80 mm (0.0307 to 0.0315 in) for engine 2400
The automatic advance lever must be in the off position, i.e. rotated towards the engine front part.

(2) Cylinder No. 1 must be coupled to pump connection marked with yellow paint.

CHECKS AND ADJUSTMENTS

ENGINE SPEED

Unit: r.p.m.

Inspection data	Engines	
	2000	2400
	VM 80 A	VM 81 A
Idle speed (1)	800 to 850	800 to 900
Max. no-load engine speed	4800 to 4830	

(1) To be measured with warm engine, gearbox in neutral, clutch engaged.

TURBOSUPERCHARGER

Inspection data			Engines	
			2000	2400
			VM 80 A	VM 81 A
Supercharging air pressure	Max pressure (engine under load at max. r.p.m.)	kPa (bar) (kg/cm^2) (p.s.i.)	88 (0.88) (0.9) (12.8)	
	Test pressure (engine in no-load condition at 4000 r.p.m.)	kPa (bar) (kg/cm^2) (p.s.i.)	39 to 45 (0.39 to 0.45) (0.40 to 0.46) (5.69 to 6.54)	
Turbosupercharger rotor clearance	End float	mm (in)	0.08 to 0.11 (0.0031 to 0.0043)	
	Radial clearance	mm (in)	0.42 (0.0165)	

FUEL SUPPLY PUMP

Inspection data			Engines	
			2000	2400
			VM 80 A	VM 81 A
Delivery pressure	Minimum value	kPa (bar, kg/cm^2, p.s.i.)	20 (0.2; 0.2; 2.84)	
	Zero supply pressure	m H_2O (ft H_2O)	0.30 to 0.40 (0.91 to 1.21)	
Delivery (at pump 2500 r.p.m.)		l/h (gall/h)	80 (17.6)	

INJECTORS

Unit: kPa (bar; kg/cm^2; p.s.i.)

Inspection data	Engines	
	2000	2400
	VM 80 A	VM 81 A
Calibration pressure	14.700 to 15.500 (147 to 155; 150 to 158; 2.134 to 2.247)	
Leakage test pressure (1)	12.740 (127.4; 130; 1.849)	

(1) Apply pressure gradually, dripping not permitted.

ACCELERATOR

Unit: mm (in)

Inspection data	Engines	
	2000	2400
	VM 80 A	VM 81 A
Accelerator control adjustment value: accelerator cable travel (min. to max.)	30.5 to 31.5 (1.2 to 1.24)	

BOSCH VE 4/9 F 2150 L 202 INJECTION PUMP TEST AND ADJUSTMENT DATA (BOSCH code 0.460.494.167)
ENGINE 2000

TEST CONDITIONS:

- Test oil: density 0.835 at 18 to 22°C (64.4 to 71.6°F)
- Test oil temperature: 35 to 40°C (95 to 104°F)
- Overflow temperature: 45°C (113°F)
- Fuel inlet pressure: 0.5 bar (0.5 kg/cm^2; 7.11 psi)
- Rotation: counterclockwise
- Injectors with KBE58S4/4 spring and DN0SD 1510 spray nozzles set to 147 ± 3.9 bar (150 ± 4 kg/cm^2; 2,133.5 ± 56.892 psi)
- Pipes: 1.5 × 6 × 980 mm (0.06 × 0.24 × 38.6 in) (flowm. Solex 63 Scale D)
- Pumping element to cut off spill

Type of test	Test No.	Governor lever position	Speed (r.p.m.)	Test voltage (V)	Automatic advance value (pressure on LDA 0.8 bar; 11.60 psi) mm (in)		Supply pump pressure value (pressure on LDA 0.8 bar; 11.60 psi) bar (psi)		Injector delivery value (no pressure on LDA) cm^3 × 1000 shots (cu·in × 1000 shots)		Injector delivery value (pressure on LDA 0.8 bar; 11.60 psi) cm^3 × 1000 shots (cu·in × 1000 shots)	
					Test	Adjustment	Test	Adjustment	Test	Adjustment	Test	Adjustment
Automatic advance	1	max.	1000	12	1.0 to 2.4 (0.039 to 0.094)	1.3 to 2.1 (0.051 to 0.083)						
	2	max.	1600	12	4.2 to 5.6 (0.165 to 0.220)	4.7 to 5.1 (0.185 to 0.201)						
	3	max.	2150	12	7.3 to 8.7 (0.287 to 0.343)	7.6 to 8.4 ((0.291 to 0.331)						
Supply	4	max.	600	12			1.5 to 2.1 (21.75 to 30.46)					
	5	max.	1600	12			4.9 to 5.5 (71.06 to 79.77)					
	6	max.	2150	12			6.7 to 7.3 (97.17 to 105.87)					
Delivery	7	max.	2550	12							MAX 20 (1.22)	
	8	max.	2420	12							11.0 to 19.0 (0.67 to 1.16)	12.0 to 18.0 (0.73 to 1.10)
	9	max.	2150	12							36.5 to 44.5 (2.23 to 2.72)	39.0 to 42.0 (2.38 to 2.56)
	10	max.	1500	12							46.8 to 51.2 (2.86 to 3.12)	48.5 to 49.5 (2.96 to 3.02)
	11	max.	1600	12					—	—		
	12	max.	750	12					33.5 to 39.5 (2.04 to 2.41)	36.0 to 37.0 (2.20 to 2.26)		
	13	min.	400	12					9.0 to 17.0 (0.55 to 1.04)	11.0 to 15.0 (0.67 to 0.92)		
Start-up	14	min.	100	12					34.0 to 50.0 (2.07 to 3.05)			

LDA: Aneroid on injection pump sensitive to supercharging air pressure.

NOTE: Test: acceptable value.
Adjustment: value to which pump should adjusted whenever test value does not fall within tolerance range given in table at r.p.m. indicated

BOSCH VE 4/10 F 2100 L 168-1 INJECTION PUMP TEST AND ADJUSTMENT DATA (BOSCH code 0.460.404.042)
ENGINE 2400

TEST CONDITIONS:

- Test oil: density 0.835 at 18 to 22°C (64.4 to 71.6°F)
- Test oil temperature: 35 to 40°C (95 to 104°F)
- Overflow temperature: 45°C (113°F)
- Fuel inlet pressure: 0.5 bar (0.5 kg/cm^2; 7.11 psi)
- Rotation: counterclockwise
- Injectors with KBE58S4/4 spring and DN0SD 1510 spray nozzles set to 147 ± 3.9 bar (150 ± 4 kg/cm^2; 2,133.5 ± 56.892 psi)
- Pipes: 1.5 × 6 × 980 mm (0.06 × 0.24 × 38.6 in) (flowm. Solex 63 Scale D)
- Pumping element to cut off spill

Type of test	Test No.	Governor lever position	Speed (r.p.m.)	Test voltage (V)	Automatic advance value (pressure on LDA 0.8 bar; 11.60 psi) mm (in)		Supply pump pressure value (pressure on LDA 0.8 bar; 11.60 psi) bar (psi)		Injector delivery value (no pressure on LDA) cm^3 × 1000 shots (cu·in × 1000 shots)		Injector delivery value (pressure on LDA 0.8 bar; 11.60 psi) cm^3 × 1000 shots (cu·in × 1000 shots)	
					Test	Adjustment	Test	Adjustment	Test	Adjustment	Test	Adjustment
Automatic advance	1	max.	1000	12	1.3 to 2.7 (0.051 to 0.106)	1.6 to 2.4 (0.063 to 0.094)						
	2	max.	1500	12	4.1 to 5.5 (0.161 to 0.217)	4.6 to 5.0 (0.181 to 0.197)						
	3	max.	2100	12	7.3 to 8.7 (0.287 to 0.343)	7.6 to 8.4 (0.299 to 0.331)						
Supply	4	max.	400	12			1.1 to 1.7 (15.95 to 24.66)					
	5	max.	1500	12			4.8 to 5.4 (69.62 to 78.32)					
	6	max.	2100	12			6.9 to 7.5 (100.07 to 108.77)					
Delivery	7	max.	2450	12							0.5 to 9.5 (0.03 to 0.58)	1.5 to 8.5 (0.09 to 0.52)
	8	max.	2300	12							23.5 to 34.5 (1.43 to 2.11)	27.0 to 33.0 (1.65 to 2.01)
	9	max.	2100	12							46.5 to 55.5 (2.84 to 3.39)	49.5 to 52.5 (3.02 to 3.20)
	10	max.	1500	12							56.5 to 61.9 (3.45 to 3.78)	58.7 to 59.7 (3.58 to 3.64)
	11	max.	1600	12					—	—		
	12	max.	600	12					36.6 to 42.0 (2.23 to 2.56)	38.8 to 39.8 (2.37 to 2.43)		
	13	min.	400	12					10.5 to 19.5 (0.64 to 1.19)	13.0 to 17.0 (0.79 to 1.04)		
Start-up	14	min.	100	12					40.0 to 60.0 (2.44 to 3.66)			

LDA: Aneroid on injection pump sensitive to supercharging air pressure.

NOTE: Test: acceptable value.
Adjustment: value to which pump should adjusted whenever test value does not fall within tolerance range given in table at r.p.m. indicated

GENERAL SPECIFICATIONS

RECOMMENDED FUEL

Diesel fuel cetane rating ⩾ 48 (Italian CUNA Std. NC 630 - 01 - 1977)

Outdoor temperature	Normal diesel fuel	Winter diesel fuel
40 to 0° C (104 to 32° F)	100%	–
– 18 to 0° C (– 0.4 to 32° F)	–	100%

FUEL ADDITION AGENTS

Use	Name	Quantity
For cold climates	D/MIX - IP	1 l (0.22 Imp. Gall.) every 200 l (43.99 Imp. Gall.) fuel (one mark of graded scale every 20 l (4.40 Imp. Gall) fuel)
To reduce the exhaust fumes	NEW CLEANER FOR DIESEL ENGINES +1 – CHALLOIS	one 0.150 kg (0.33 lb) tin (0.125 l) (0.027 Imp. Gall.) every 50 l (11 Imp. Gall.) fuel

FLUIDS AND LUBRICANTS

Application	Type	Name	Q.ty
Bush on the accelerator pedal rotation pin	GREASE	AGIP Grease 15 Std. No. 3671-69810	As required
Accelerator pedal spring	GREASE	ISECO Molykote Paste G Std. No. 3671-69840	As required
Accelerator pedal shaft (on support rubbers)	GREASE	ISECO Molykote Longterm No. 2 Std. No. 3671-69831 ISECO Molykote Paste G Std. No. 3671-69840	As required As required
Accelerator pedal boot (only for L.H. drive vehicles)	GREASE	REINACH: E 10 Tac Std. No. 3671-69812	As required

SEALANTS AND ADHESIVES

Application	Type	Name	Q.ty
Engine block flange for injection pump attachment	JOINTING COMPOUND	LOWAC PERFECT SEAL Std. No. 3522-00011	As required

TIGHTENING TORQUES

Unit: N·m (kg·m; ft·lb)

Item	Engines	
	2000	2400
	VM 80 A	VM 81 A
Injector retaining nuts	24.5 to 29.4 (2.5 to 3; 18.1 to 21.7)	
Injection pump drive gear retaining nut (1)	88.2 (9; 65.1)	
Fuel delivery pipe connections	14.7 to 19.6 (1.5 to 2; 10.8 to 14.5)	
Turbosupercharger retaining nut (1)	24.7 to 27.4 (2.5 to 2.8; 18.1 to 20.2)	

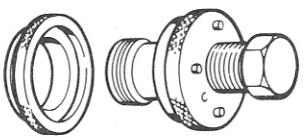
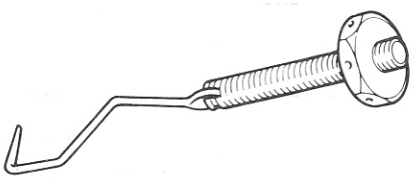
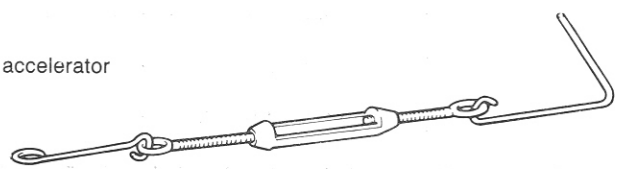
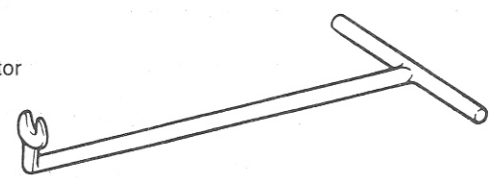
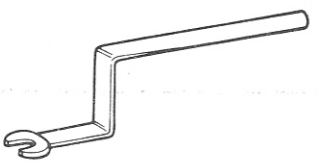
(1) with engine oil

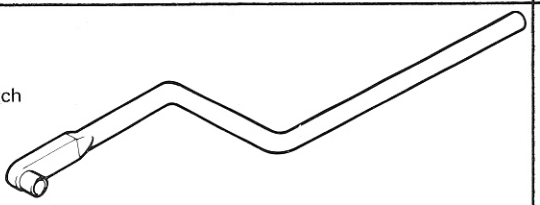
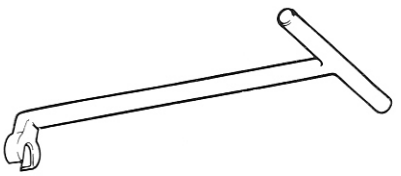
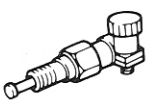
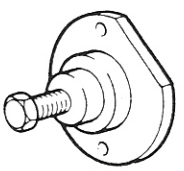
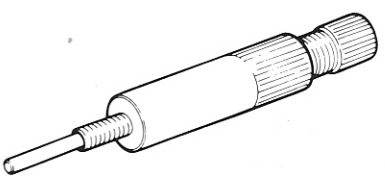
TROUBLE DIAGNOSIS AND CORRECTIVE ACTIONS

Condition	Probable cause	Corrective action
Engine idle r.p.m. not steady	• Injection pump faulty	Replace pump
	• Fuel piping and/or filter clogged	Replace piping and/or filter
	• Injectors faulty	Overhaul injectors - Replace spray nozzles if required
	• Idle r.p.m. too low	Adjust
Engine fails to accelerate	• Fuel filter clogged	Replace filter
	• Delivery valve on injection pump faulty	Overhaul valve
	• Injection pump faulty	Overhaul pump
	• Fuel pump faulty	Replace pump
Black exhaust fumes	• Injection pump faulty	Overhaul pump
	• Injectors faulty	Overhaul injectors
	• Air filter clogged	Replace filter
	• Supercharging pressure low	Check pressure and tightness of air supply system. Replace waste gate valve on turbocharger, if required. Check tightness of intake sleeves
	• Turbocharger rotor blocked	Replace turbocharger. Check lubrication system
Power loss	Refer to previous step plus: • Exhaust system inefficient	Replace the faulty components
	• Turbocharger oil rings inefficient	Replace turbocharger
	• Poor tightness of valves	Overhaul cylinder heads
	• Valve backlash incorrect	Adjust
White or blue exhaust fumes	• Excessive oil in the sump	Drain the exceeding oil
	• Turbocharger oil rings inefficient	Replace turbocharger
	• Supercharging pressure too high	Replace waste gate valve
	• Cylinder liners and valve guide worn, oil rings sticking	Overhaul engine and head
	• Head gasket burnt	Overhaul head and replace gasket

Condition	Probable cause	Corrective action
Turbocharger noisy	• Blading damaged	Check rotors condition; replace turbocharger if required
	• Rotor bearings clearance excessive	Replace turbocharger
	• Poor lubrication	Check lubrication system. Use proper oil

SPECIAL SERVICE TOOLS

Tool number	Tool name	Refer page
A.3.0612	Injection pump puller 	04-12/1 04-13
A.4.0217	Operating tie rod for automatic advance lever 	04-18 04-19
A.4.0218	Operating tie rod for accelerator control lever 	04-18 04-19
A.5.0252	Wrench for nut securing accelerator lever pin 	04-19
A.5.0253	Wrench for the screw of r.p.m. - accelerator microswitch control lever 	04-17 04-18

Tool number	Tool name	Refer page
A.5.0254	Shim (5,5 mm) for microswitch control lever adjustment 	04-17
A.5.0257	Wrench for fuel inlet union on injection pump 	04-16 04-17
A.7.0333	Dial gauge bracket for timing the injection pump 	04-14 04-15
A.7.0384	Puller for BOSCH injection pump 	04-12 04-13
C.6.0201	Comparator holder for injection pump timing (for timing verification on vehicle) 	04-14

GROUP 05

CONTENTS

(*) Refer to: "WORKSHOP MANUAL - **engines**"- PETROL ENGINES - GROUP 05

STARTING

LIGHTENED BOSCH MOTOR WITH BUILT - IN REDUCER

OVERHAUL AND INSPECTION

Refer to: ''WORKSHOP MANUAL - **engines**''- PETROL ENGINES - GROUP 05 - Starting - BOSCH motor with built-in reducer.

TECHNICAL DATA

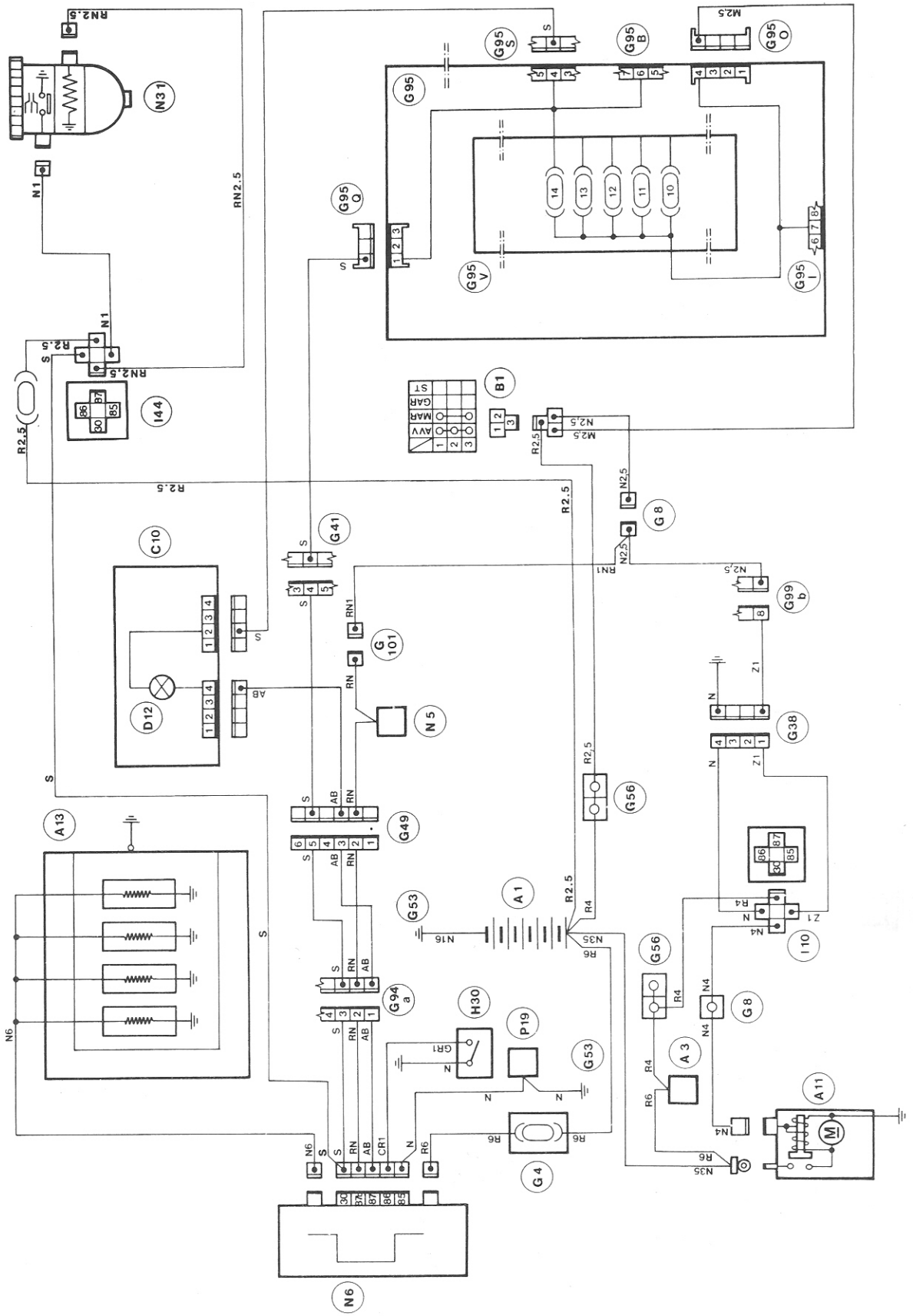
Refer to: Service Data and Specifications

STARTING SYSTEM WIRING DIAGRAM

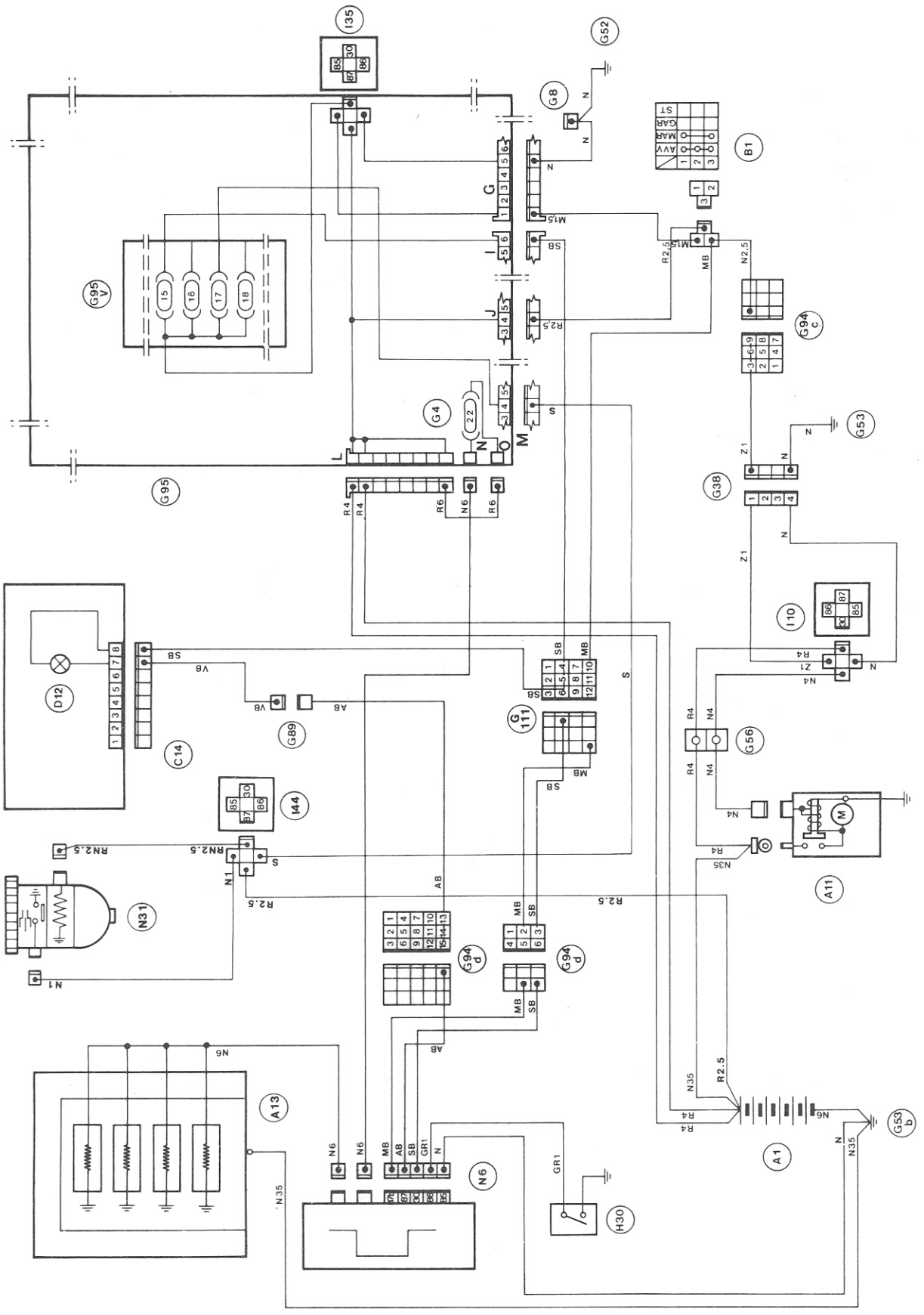
Key

A1	Battery
A3	Alternator with integral electronic voltage regulator
A11	Starter motor
A13	Glow plugs
B1	Ignition switch
C10	Cluster
C14	Warning lamps panel
D12	Pre-heating glow plug warning lamp
G4	Free fusebox
G8	Single connector
G38	Connector for air conditioner wiring
G41	Connector for tachymetric switch-rev counter pulse generator
G49	Connector available
G52	Fusebox ground
G53	Engine compartment ground
G53b	Engine compartment ground - left side
G56	Branch terminal board
G89	Intermediate connector A
G94a	10-way connector for engine compartment
G94c	Engine compartment connector - right side
G94d	Engine compartment connector - left side
G95	Central fusebox
G95B	Connector for switches
G95G	Connector for combination switch
G95I	Connector for RH interface
G95L	Connector for clock - rheostats
G95N	Connector for battery
G95O	Connector for ignition switch
G95Q	Connector for performance gauge
G95S	Connector for cluster
G95V	Fuses
G99b	Connector for engine dashboard (B)
G101	Trip Computer connector
G111	Connector for dashboard instruments wiring
H30	R.p.m. - activated microswitch
I10	Starter inhibitor relay
I35	Key - operated supply relay
I44	Fuel pre-heating device relay
N5	Tachymetric switch device
N6	Pre-heating glow-plug timer
N31	Fuel pre-heating device
P19	Windscreen washer pump

Wiring diagram **Alfa 90 2.4 turbodiesel**
Alfa 90 Super 2.4 turbodiesel



Wiring diagram **Alfa 75 2.0 turbodiesel**



CHARGING

BOSCH ALTERNATOR

OVERHAUL AND INSPECTION

Refer to: "WORKSHOP MANUAL - **engines**". PETROL ENGINES - Group 05 - Charging - BOSCH Alternator.

TECHNICAL DATA

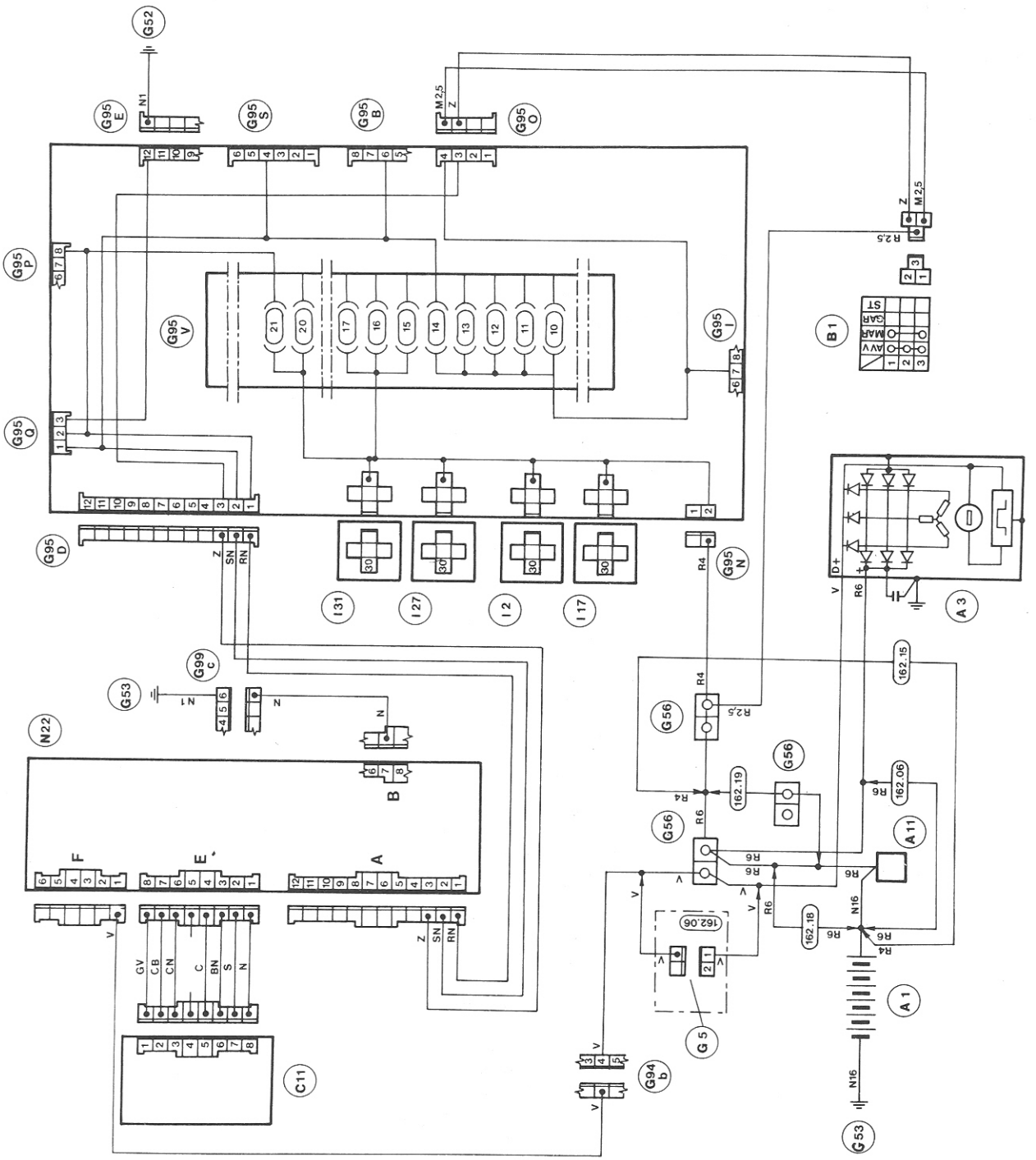
Refer to: Service Data and Specifications.

CHARGING SYSTEM WIRING DIAGRAM

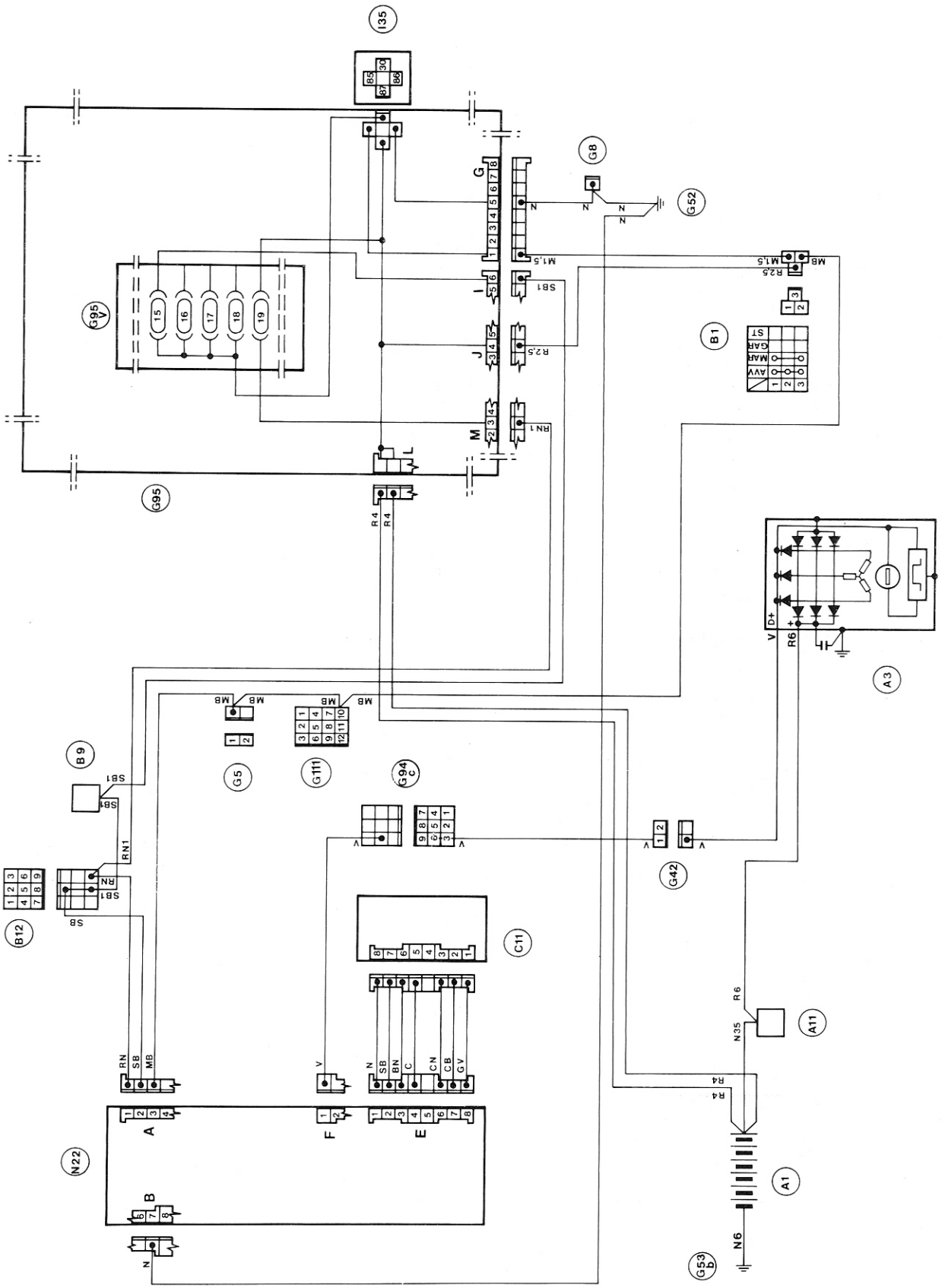
Key

A1	Battery
A3	Alternator with integral electronic voltage regulator
A11	Starter motor
B1	Ignition switch
B9	Heated rear window control switch
B12	Road hazard lights control switch
C11	ALFA ROMEO Control display
G5	Multiple connector
G8	Single connector
G42	Connector between alternator and min engine oil pressure switch
G52	Fusebox ground
G53	Engine compartment ground
G53b	Engine compartment ground - left side
G56	Branch terminal board
G94b	8-way connector for engine compartment
G94c	Right side engine compartment
G95	Central fusebox
G95B	Connector for switches
G95D	Connector for ALFA ROMEO Control
G95E	Connector for console
G95G	Connector for combination switch
G95I	Connector for RH interface
G95L	Connector for clock - rheostats
G95M	Connector for sun - roof
G95N	Connector for battery
G95O	Connector for ignition switch
G95P	Connector for door services
G95Q	Connector for performance gauge
G95S	Connector for cluster
G95V	Fuses
G99c	Connector for engine dashboard (C)
G111	Connector for dashboard instrument wiring
I2	Heated rear window relay
I17	Fog light relay
I27	Seat height adjustment relay
I31	Front power windows/heater relay
I35	Key-operated supply relay
N22	ALFA ROMEO Control control unit

Wiring diagram **Alfa 90 2.4 turbodiesel**
Alfa 90 Super 2.4 turbodiesel



(wiring diagram **Alfa 75** **2.0** *)*



SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

STARTER

Data			Engines	
			2000	2400
			VM 80 A	VM 81 A
Motor	Alfa Romeo part No.		116.61.05.030.02	116.61.05.030.00 (*)
	Type		BOSCH0001233039 EV → 12V - 2.2 kW	BOSCH0001218007 EV → 12V - 2.2 kW
Power		kW	2.2	
Pinion teeth module		mm	2.1167	

(*) Premodification solution
(**) Postmodification solution

ALTERNATOR/REGULATOR

Data			Engines	
			2000	2400
			VM 80 A	VM 81 A
Alternator	Alfa Romeo part No.		116.76.05.060.00	
	Type		BOSCH 0120489838 K1 → 14V - 55A20	
Current maximum output		A	55	

BATTERY

Data			Engines			
			2000		2400	
			VM 80 A		VM 81 A	
Capacity		Ah	88	92	88	92
Discharge current		A	380			

INSPECTIONS AND ADJUSTMENTS

STARTER

Inspection data			Engines	
			2000	2400
			VM 80 A	VM 81 A
Running torque test (flywheel in mesh with ring gear and dyn. brake on)	Voltage	V	8	
	Current	A	⩽680	
	Speed	r.p.m.	⩾1200	
	Torque	N·m	19	
		(kg·m)	(1.9)	
		(ft.lb)	(13.74)	
Lock torque test (starter drive locked)	Voltage	V	4	
	Current	A	⩽1300	
	Torque	N·m	⩾37	
		(kg·m)	(⩾3.8)	
		(ft.lb)	(⩾27.47)	
Light running torque test		N·cm	14 to 22	
		(kg·cm)	(1.4 to 2.2)	
		(in.lb)	(131.6 to 206.8)	
Min. starting voltage of starter solenoid switch (on motor) (at 20°C) (68°F)		V	⩽7.8	

ALTERNATOR/REGULATOR

Unit: r.p.m.

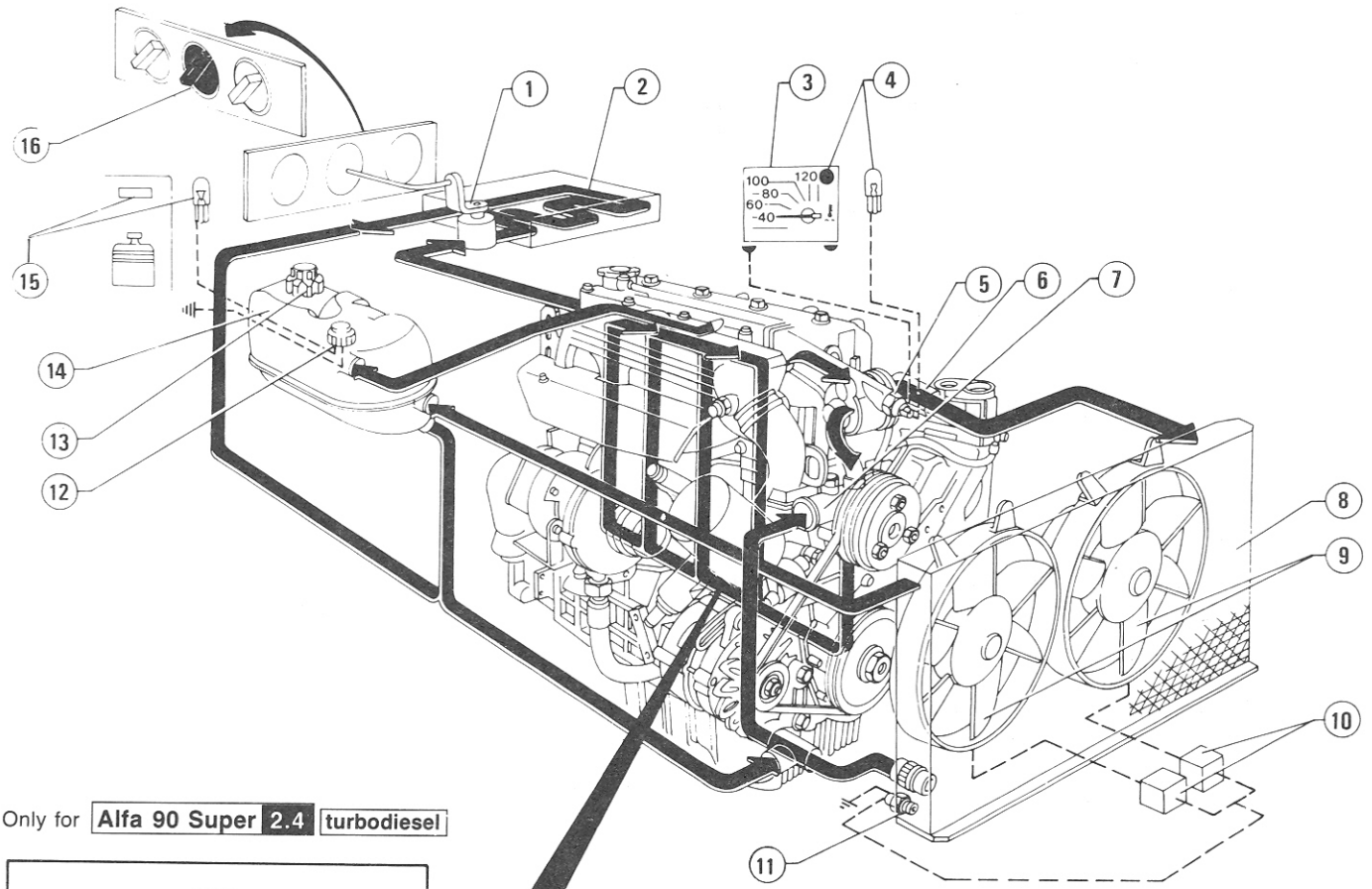
Inspection data		Engines	
		2000	2400
		VM 80 A	VM 81 A
Electrical data	Cut-in speed	1000	
	2/3 Max. output speed	2000	
	Max. output speed	6000	

GROUP 07

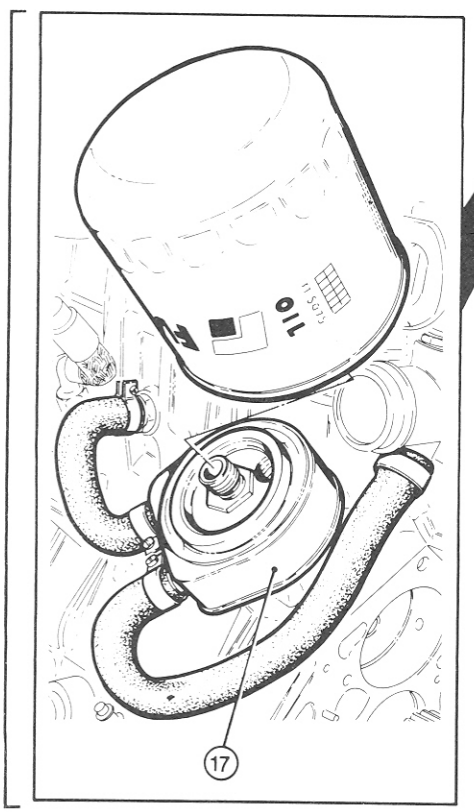
CONTENTS

COOLING SYSTEM

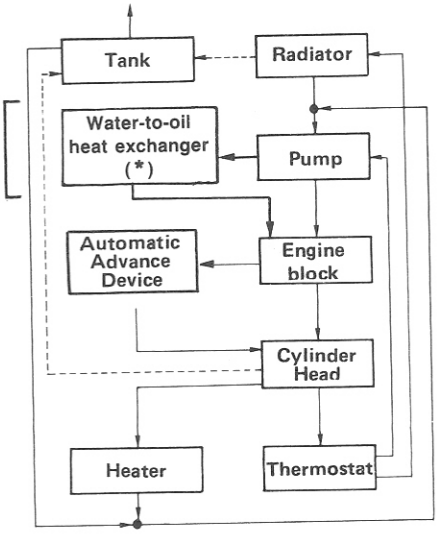
GENERAL DESCRIPTION



Only for **Alfa 90 Super 2.4 turbodiesel**



1 Heater cock
2 Heater
3 Coolant temperature indicator
4 Max coolant temperature warning lamp
5 Bulb for coolant temperature indicator and max temperature warning lamp
6 Thermostat
7 Pump
8 Radiator
9 Electric fans
10 Electric fans control relays
11 Electric fans control thermal switch
12 Coolant level sensor
13 Pressurized cap
14 Header tank
15 Min coolant level warning lamp (ALFA ROMEO Control)
16 Heater cock control
17 Water-to-oil heat exchanger



(*) *Only for vehicles*
Alfa 90 Super 2.4 turbodiesel

Cooling system is of the sealed type, with header tank and permanent antifreeze liquid. The circulation of liquid is ensured by a centrifugal pump belt-driven by crankshaft.
A thermostat, permits the engine to be brought quickly at the normal running temperature and kept at the optimal values; thermostat opens when coolant reaches **80°C (176°F)** approx.
In addition to the air ram effect, the radiator is also cooled by two electric fans controlled by a thermal switch, located on radiator.

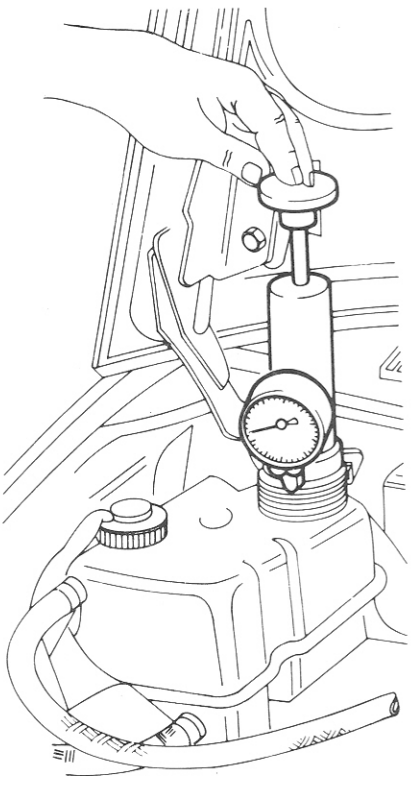
Furthermore, the system supplies also the automatic advance device which, varies the injection pump advance in relation to coolant temperature.
The system is fitted with a coolant temperature sensor which supplies the max temperature indicator and warning lamp, on cluster. The warning lamp illuminates when coolant temperature exceeds **105°C (221°F)**.
A sensor, on header tank, provides an indication (through ALFA ROMEO Control) whenever coolant level in the tank goes below the min value.

• *Only for vehicles*
Alfa 90 Super 2.4 turbodiesel
The system also accounts for engine oil cooling through a water-to-oil heat exchanger connected to the pump and the engine block by means of piping.

SYSTEM TIGHTNESS TEST

1. Unscrew the header tank pressurized cap.
2. Screw tester on header tank union.
3. Pressurize the system and verify, on tester, that pressure remains within the prescribed value.

Coolant system check pressure
107.9 kPa
(1.08 bar; 1.1 kg/cm^2; 15.64 p.s.i.)



COOLANT PUMP

REMOVAL

1. Disconnect the battery negative terminal; then drain and recover coolant.

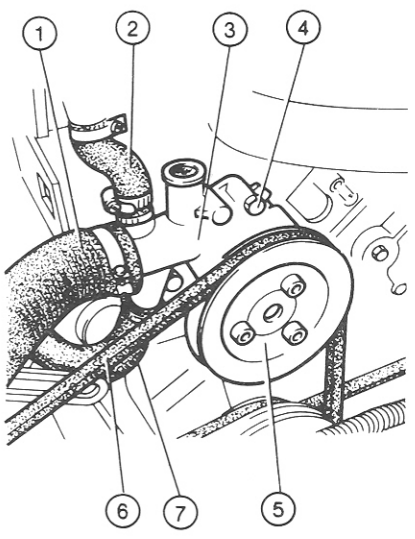
WARNING:
Take the utmost care when draining coolant with hot engine, to avoid being burned.

2. Unscrew the bolts securing alternator and move it so as to loosen belt (6); then remove belt from pulley (5).

3. Disconnect hose (2), sleeve (1) and only for vehicles
Alfa 90 Super 2.4 turbodiesel,
sleeve (7) from pump (3).

4. If required, unscrew the securing screws and remove pulley (5) from pump shaft.

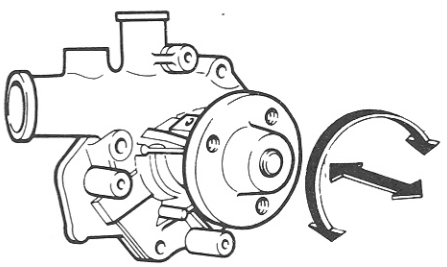
5. Unscrew the four screws (4) and remove pump (3) with related gasket.



1 Radiator coolant outlet sleeve
2 Manifold coolant outlet hose
3 Coolant pump
4 Screw securing pump to engine block
5 Pulley
6 Alternator and pump drive belt
7 Cooling-system liquid delivery sleeve to water-toòoil heat exchanger
Only for vehicles
Alfa 90 Super 2.4 turbodiesel

CHECKS AND INSPECTIONS

1. Thoroughly clean the pump body and the plane of coupling flange to engine block.
2. Check pump body and rotor; replace if seriously oxidized or corroded.
3. Check for excessive backlash during rotation and in the axial movement.



INSTALLATION

1. Place the coolant pump on the engine block seat, interposing a new gasket; secure pump to block tightening the screws to the prescribed torque.

(T): **Tightening torque**
Screws securing coolant pump to engine block, in engine oil
24.5 N·m
(2.5 kg·m;
18.1 ft·lb)

2. Complete the installation by reversing the order of removal, complying with the following indications.

- Put the pump - alternator drive belt under tension (refer to: WORKSHOP MANUAL **Alfa 90** - Group 00 - Engine Maintenance - Checking Good Conditions - Replacing and Adjusting the Alternator Drive Belt).
- Fill the system with the type and quantity of liquid prescribed.
- Start the engine, bring it to the normal running conditions and check for leaks.

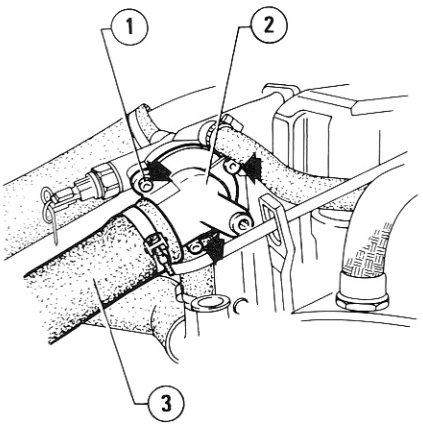
THERMOSTAT

REMOVAL

1. Disconnect sleeve (3) from thermostat (2).

Recover coolant.

2. Unscrew the three screws (1), and remove thermostat (2) with the interposed gasket.



1 Screws securing thermostat to manifold
2 Thermostat
3 Coolant - to radiator delivery sleeve

CHECKS AND INSPECTIONS

By means of suitable equipment, verify the following:

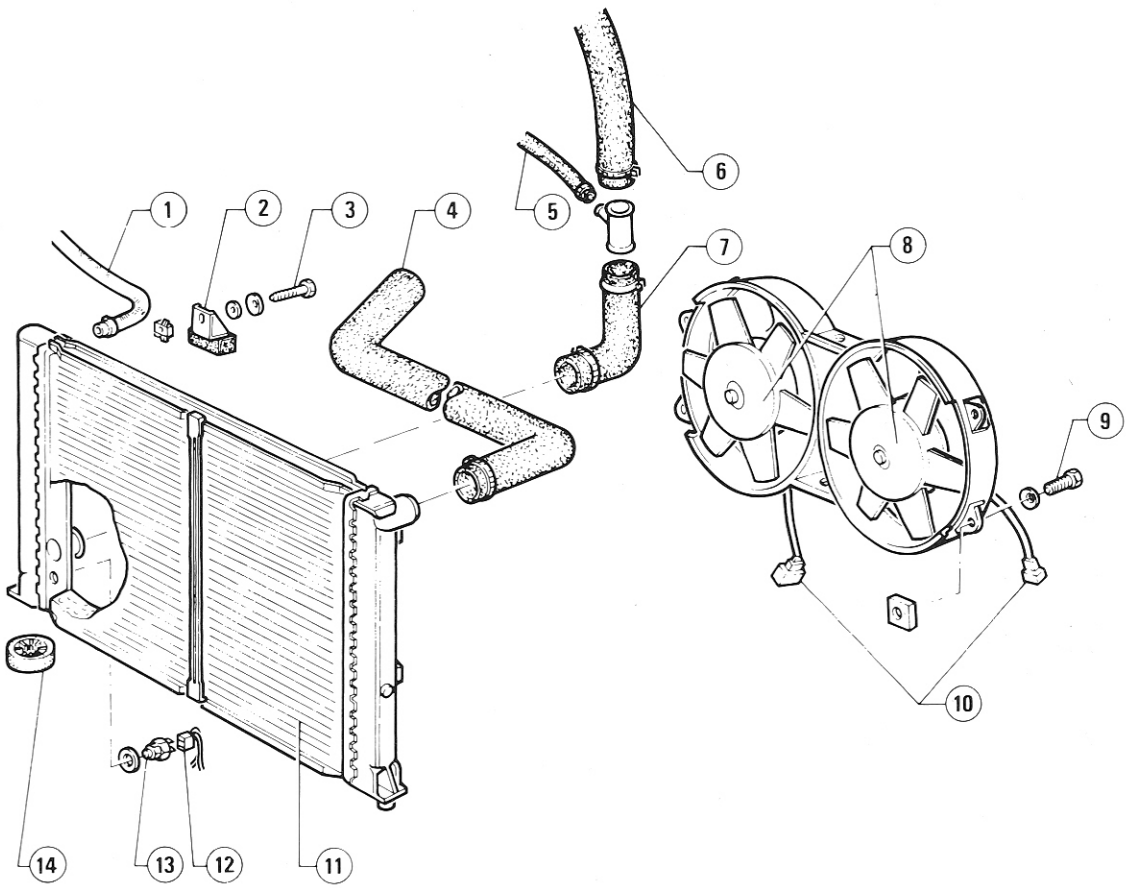
- thermostat shall open when coolant temperature reaches **80°C (176°F)**
- thermostat shall open fully when coolant - temperature reaches **95°C (203°F)**. Verify also that, in these conditions, the thermostat valve movement is greater or equal to **8 mm (0.315 in)**.

If not so, replace thermostat.

INSTALLATION

1. Clean the thermostat mating surfaces.
2. Place thermostat on the housing, interposing a new gasket; tighten the screws, and reconnect the coolant - to radiator delivery sleeve.
3. Restore coolant level.

RADIATOR



1 Radiator breather hose
2 Bracket
3 Screw securing radiator to body
4 Radiator coolant inlet sleeve
5 Return hose from heater
6 Coolant - to pump delivery sleeve
7 Radiator coolant outlet sleeve
8 Electric fans
9 Screw securing electric fans to radiator
10 Connectors for electric fans supply cables
11 Radiator
12 Connector for electric fans control cable
13 Electric fans control thermal switch
14 Rubber pad

REMOVAL AND INSTALLATION

1. Disconnect battery.
2. Detach sleeve (7) from radiator; drain and recover coolant.

WARNING:
Proceed with care when working on a hot engine to avoid being burned.

3. Detach sleeve (4) and hose (1) from radiator.
4. Detach connectors (10) of the electric fans supply cables, and connector (12) from thermal switch (13). Cut the plastic clamp on radiator and disconnect the left electric fan supply cable.
5. Unscrew screw (3) securing radiator (11) to body; remove radiator from engine compartment and withdraw rubber pads (14).
6. If required, unscrew screws (9) and remove electric fans (8) from radiator.
7. Carry out the installation by reversing the order of removal, then refill with coolant operating as follows.

a. Remove the header tank cap, and refill with the prescribed liquid.

Cooling system refill

Min. external temperature	°C °F	−20 −4	−35 −31
Concentrated anti-freeze Std. N. 3681-69956	l Imp. gall.	3.6 0.79	5 1.10
Dilution distilled water	l Imp. gall.	6.4 1.41	5 1.10
Antifreeze ready to use Std. N. 3681-69958	l Imp. gall.	10 2.2	– –

To increase the antifreeze protection from −20°C (−4°F) to −35°C (−31°F) without draining the whole system, replace 2.5 l (0.55 Imp. Gall.) mixture with as many litres of specific concentrated antifreeze.

CAUTION:
Products harmful to paint. Avoid contact with painted surfaces.

b. Start the engine and bring it to the normal running temperature so as to allow coolant circulating in the system, and operate on heater control so as to cause radiator liquid cock to open.
c. On cold engine, top-up with coolant up to the max level marked on header tank.

TIGHTNESS TEST

1. Remove radiator from vehicle (refer to: Removal and Installation).
2. Plug the coolant inlet/outlet unions to/from radiator.
3. Immerge radiator into a tank previously filled with water and identify any leaks by blowing compressed air into the radiator breather hose, until obtaining **107.9 kPa (1.08 bar; 1.1 kg/cm^2; 15.64 p.s.i.)** pressure.
4. If leaks are present, replace radiator operating as described in: Removal and Installation.

ELECTRIC FANS CONTROL THERMAL SWITCH

REPLACEMENT

1. Raise vehicle on a lift.
2. Drain and recover coolant.
3. Detach the connectors from the thermal switch on radiator.
4. Unscrew thermal switch and remove it from radiator.
5. **Lubricate** the thermal switch threading with **Antiseize E. GORI: Never Seez**; then screw switch on radiator, interposing a new gasket and tighten it to the prescribed torque.

(T): **Tightening torque**
Electric fans control thermal switch on radiator
20 to 25 N·m
(2 to 2.5 kg·m;
18.1 ft·lb)

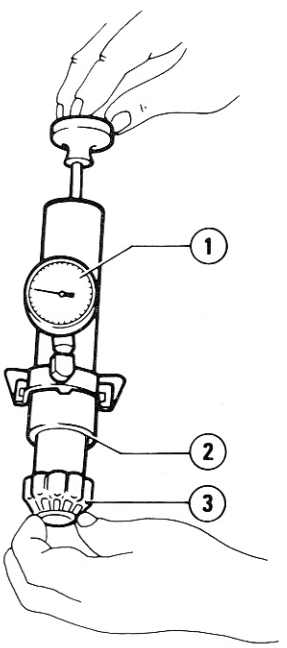
6. Restore coolant level.
7. Start the engine and warm it up until coolant reaches a temperature within **84 to 88°C (183.2 to 190.4°F).**
8. Verify that, at this temperature, the thermal switch enables the electric fans operation.

PRESSURIZED CAP

TIGHTNESS TEST

1. Screw union (2) on tester, and insert this one on the header tank pressurized cap.
2. Pressurize the cap and verify, on tester, that the relief valve opens at the setting pressure.

Pressurized cap setting pressure
88.3 to 107.9 kPa
(0.88 to 1.08 bar;
0.9 to 1.1 kg/cm^2;
12.80 to 15.64 p.s.i.)



1 Tester
2 Union
3 Cap

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

TEMPERATURES

Setting of coolant thermostat:

- opening 80°C (176°F)
- closing 95°C (203°F)
- bulb travel ⩾8 mm (⩾0,315 in)

Electric fans engagement temperature 84 to 88° C (183.2 to 190.4°F)

Oil thermostat temperature

- opening 80 to 84°C (176 to 183.2°F)
- closing 94.5°C (202.1°F)
- bulb travel ⩾7.8 mm (⩾0,307 in)

PRESSURIZED CAP

Pressurized cap setting pressure 88.3 to 107.9 kPa (0.88 to 1.08 bar) (0.9 to 1.1 kg/cm^2) (12,80 to 15,64 p.s.i.)

BELT TENSIONING

With a load "p" of 147 ± 9.8 N (15 ± 1 kg; 33.07 ± 2.2 lb) applied in the middle of belt, arrow "f" must be 20 mm (0.787 in).

CAUTION:
a. To increase the antifreeze protection from –20°C (–4°F) to –35°C (–31°F) without draining the whole system, replace part of mixture with as many litres of concentrated antifreeze 2.5 litres (0.55 Imp. gall.).
b. If the coolant level sensor is to be replaced, take care when reassembling, to tighten cap thorougly so as to ensure tightness.

WARNING:
Products harmful to point. Avoid contact with pointed surfaces.

CHECKS AND ADJUSTMENTS

RADIATOR

Radiator tightness check pressure 107.9 kPa (1.08 bar) (1.1 kg/cm^2) (15.64 p.s.i.)

GENERAL SPECIFICATIONS

COOLANT

Min. temperature	°C / °F	–20 / –4	–35 / –31
Concentrated antifreeze Std. N. 3681-69956	l	3.6	5
	Imp. gall.	0.79	1.10
Distilled water	l	6.4	5
	Imp. gall.	1.41	1.10
Antifreeze ready to use Std. N. 3681-69958	l	10	–
	Imp. gall.	2.2	–

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Q.ty
Threading of electric fans control thermal switch on radiator	ANTI-SEIZE	R. GORI: Never Seez Std. N. 3671-69850	As required

SEALANTS AND FIXING AGENTS

Application	Type	Denomination	Q.ty
Cooling system sealant	SEALING POWDER	AREXONS Std. N. 3522-00101	30 g (1.06 oz)

In alternative, ALUMASEAL can be used

TIGHTENING TORQUES

Item \ Unit	N·m	kg·m	ft·lb
Coolant ternperature sender on air supply manifold	49	5	36.15
Electric fans control thermal switch on radiator (with antiseize R. GORI: Never Seez)	20 to 25	2 to 2.5	14.5 to 18.1
Engine oil thermostat (with engine oil)	68.6 to 78.4	7 to 8	50.6 to 57.8

TROUBLE DIAGNOSIS AND CORRECTIVE ACTIONS

Condition	Probable cause	Corrective action
Coolant leaks	• Radiator damaged	Replace radiator
	• Leaks in the system sleeves	Replace the damaged sleeves
	• Clamps loosened or broken	Tighten or replace
	• Thermostat leaks	Replace gasket or thermostat
	• Cylinder head gasket damaged	Replace. Check for engine oil fouling
	• Screws securing cylinder head loosened	Restore correct tightening
Coolant circulation insufficient	• Ducts clogged	Check ducts and clean the system
	• Coolant quantity insufficient	Top-up
	• Coolant pump faulty	Replace
	• Alternator - coolant pump drive belt loosened	Restore correct tensioning
Corrosion and deposits	• Improper coolant	Replace coolant following the scheduled periods prescribed. As regards the use, follow the instructions provided on the bottle/tin
Overheat	• Thermostat faulty	Replace
	• Radiator with deposits or dirty	Clean ducts washing with specific liquid. As regards the use, follow the instructions provided on the bottle/tin
	• Poor lubrication	Restore oil level
	• Coolant pump faulty	Replace
	• Coolant quantity insufficient	Restore coolant level and verify system tightness
	• Electric fan control thermal switch faulty	Replace thermal switch
	• Electric fans faulty	Replace

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